The INTERNATIONAL JOURNAL OF ORTHODONTIA

MARTIN DEWEY, D.D.S., M.D., Chicago, Ill.
Editor-in-Chief

H. C. POLLOCK, D.D.S., St. Louis, Mo.
Associate Editor

JAMES DAVID McCOY, D.D.S., Los Angeles, Calif.
Editor, Department of Dental and Oral Radiography

VOLUME III
JANUARY-DECEMBER, 1917

ST. LOUIS
THE C. V. MOSBY COMPANY
1917

The International Journal of Orthodontia

Editor: Martin Dewey, D.D.S., M.D.

VOL. III ST. LOUIS, JANUARY, 1917 No. 1

ORIGINAL ARTICLES

FACE FACTS

(Continued from page 408, Vol. II.)

BY B. E. LISCHER, D.M.D., ST. LOUIS.
Professor of Orthodontics, Washington University Dental School.

IN the remaining essays of this series the writer will describe briefly the structural changes and disturbances of function of dentofacial deformities, outline the prognosis of the principal types, and incidentally demonstrate the utter fatuity of a numerical diagnostic terminology.

VIII. PATHOLOGY, PROGNOSIS, AND FACIAL TYPES OF NEUTROCLUSION.

Neutroclusion may be defined as a term applicable to cases of malocclusion of the teeth presenting a neutral, or normal, mesio-distal relation of the dental arches. Sundry extreme bimaxillary malformations present arch relationships of this type, but they are excluded from this group because they justify separate consideration. They will be described in a subsequent chapter.

Neutroclusion may also be defined as a class of oral deformities comprising a large variety of abnormal dental and facial types. For the sake of convenience, the various forms included in this class may be divided into *simple neutroclusion and complex neutroclusion.* The former term is applicable to all simple cases, especially when in the first stages of maldevelopment. These frequently present what have been termed "mixed dentures:" i.e., dentures composed of temporary as well as permanent teeth. Under complex neutroclusion we may include all neutroclusion cases presenting facial deformity and anomalies of dentition which are commonly regarded as complicated.

The relative frequency of these two forms is not known. Of 500 models in the author's collection which have thus far been indexed, 163 belong to the simple neutroclusion group and 185 were diagnosed as complex. It should not be forgotten, however, that an orthodontist's models are made of abnormal den-

tures and that the correct percentage should be based upon the findings in at least one thousand individuals taken at random.

Malposition of one or more teeth is always present and constitutes the primary pathological feature, resulting in an *anomaly of arch form*. Varying degrees of deformity of the face and alveolar process are also met with, as well as abnormalities of the nasal tract and accessory sinuses, abnormal nasal and lip function, abnormal articulation in speech, dental caries, anomalies of form, of number, and of eruption of the teeth, etc.

SIMPLE NEUTROCLUSION.

Fig. 39 shows models of a case of simple neutroclusion at eight years of age. It will be noticed that this denture is composed of twelve temporary and

Fig. 39.—A common form of simple neutroclusion at eight years.

eleven permanent teeth. A crowding of the incisors and an arrest of development in the alveolar process, which prevented the labial and buccal expansion of the dental arches, are the principal characteristics to be considered. My record shows that the facial features are not involved, that the child is immune to caries, her general health excellent and her weight and development above the normal for her age. Her history reveals that her parents suffer from malocclusion of the teeth, but otherwise it is entirely negative.

The cause, or causes, of such a denture are unknown. It may be that diet and disuse are causative factors of considerable importance; but the immunity to caries in this instance precludes their acceptance. Some writers would probably blame heredity, or at least hereditary predisposition, as a cause

—these are very convenient terms—but in the light of our present knowledge of heredity and the very meager statistics regarding its "influence" upon human dentition, we are utterly unable to establish such a claim.

But this we do know, that if this child's denture is not corrected at this age the malocclusion will become more firmly established and very probably more complicated. In other words, an upper central incisor in linguoversion will never correct itself; and the subsequent shedding of the remaining temporary teeth practically never promotes the normal eruption of succedaneous teeth into an already crowded arch. On the other hand, mechanical intervention at this time may easily be made to promote growth, and it is certainly most opportune.

Fig. 40.—Simple neutroclusion of the permanent teeth at fourteen years.

Fig. 40 is made from models of a similar case at the age of fourteen years which was undoubtedly in process of maldevelopment at eight years. Six years of neglect did not result in a cure, and though it may still be diagnosed as a simple neutroclusion, nothing has been gained by postponing the treatment. Obviously, time and nature, unaided, did not exercise a corrective influence; and in this connection we ought to remember that most malocclusions are progressive, not static. The prognosis of oral deformities is about as favorable as the prognosis of dental caries; their evil consequences are equally certain. Of course, every practitioner can relate case histories which showed some improvement without treatment; the natural forces of growth seemed to so assert themselves that intervention became unnecessary. But our records are

so poor and our case histories so inaccurate and inadequate, that any orthodox generalization regarding the advantages (?) of deferred treatment is decidedly delusive.

Dentures like the above frequently follow a perfectly normal temporary

Fig. 41.—An upper dental arch at three years showing extreme linguoversion of the lateral incisors. The second molars have not yet erupted.

Fig. 42.—A rare form of simple neutroclusion at the advanced age of fourteen years.

dentition and many orthodontists are, therefore, of the opinion that the temporary teeth are rarely abnormal, that most malocclusions begin with the eruption of the permanent teeth. They further hold that most oral deformities are acquired and the result of environmental influences which affect the per-

manent teeth only. But such conclusions are contingent because we have no statistics to confirm them.

Fig. 41 shows an upper arch of a girl three and one-half years old with a pronounced linguoversion of the lateral incisors. It will also be noticed that the second temporary molars have not yet erupted. It is very unfortunate that the relative frequency of the various types of malocclusion in purely ***temporary dentures*** is unknown.

Fig. 42 shows models of an unusual case of simple neutroclusion at the age of fourteen. The reader will note that all of the temporary teeth have been lost and that all of the permanent teeth except the third molars have

Fig. 43.—An early stage of a severe form of neutroclusion at seven years. Compare with Fig. 44.

erupted. Only two of the permanent teeth are in malposition and the mesiodistal space for the left upper central incisor is ample for its correction, which is very rare at so advanced an age.

The history of this case was entirely negative and the teeth were free from caries. The most important pathological features may be enumerated as follows: torso-infraversion of the upper central incisor and torsoversion of the left upper lateral; an overdevelopment of the frenum of the upper lip and a slight impairment of articulation in speech. The abnormality was quite visible during animated conversation and laughter, but the well developed lips gave no hint of the deformity within when they were in repose.

In Fig. 43 the denture of a boy seven years old is shown which exhibits

marked arrest of development in both arches. The space between the upper permanent central incisors and temporary cuspids is wholly inadequate for the accommodation of the permanent lateral incisors. Several of the deciduous teeth are affected by caries, and the function of mastication has thus been seriously impaired. Adenoids are also present and the general physical development of the lad is subnormal. His parents suffer from malocclusions of the neutroclusion type and a younger brother has recently been put under treatment for a pronounced bilateral distoclusion. An older sister, on the other hand, has a normal denture. But the main reason for presenting this case

Fig. 44.—The ultimate result of delay; age fourteen.

is to show that it is the beginning of a far more complex type, Fig. 4. The latter is made from a girl fourteen years old. At seven years this denture was in all probability similar to the one shown in Fig. 43.

In Fig. 45 we note a neutroclusion at thirteen years presenting an abnormal development of the frenum of the upper lip and consequent distoversion of the upper central incisors. The upper laterals are in extreme linguoversion and the upper cuspids, bicuspids and molars slightly so. We may also note a marked arrest of development in the alveolar process surrounding the upper anterior teeth, and a crowding of the lower incisors. The arrest of development was further complicated by nasal obstruction (due to adenoids), an impairment of the voice and a slight malrelation of the lips. Caries in several of the teeth had been treated by a dentist and the nasal passages were subsequently treated by a rhinologist. The linguoversion of the upper lateral incisors could at least have been partially prevented by treatment of the central

incisors prior to the eruption of the laterals. In Fig. 46 the models of a similar case at seven years are shown. In most cases an early treatment of the centrals is therefore advisable.

If the histories of individuals presenting this type are carefully studied, they will usually reveal the existence of an abnormal frenum and a wide space (diastema) between the central incisors during the entire period of the temporary teeth. And I am convinced that it is a mistake to speak of an abnormal frenum as a "local" or "acquired" cause. In fact Wiedersheim has shown

Fig. 45.—A neutroclusion with abnormal frenum of the upper lip at thirteen years; compare with Fig. 46.

that the raphe and papilla palatina are more highly developed in the embryo and during early infancy than in later life; that after birth, as the period of tooth eruption approaches, they diminish in size. It is probable that in these abnormal cases this diminution does not take place. The papilla palatina has been investigated by Merkel, who found it to be a sensory organ and he suggests that in early life it probably assists the palatine ridges in the trituration of food.

The writer has frequently observed the same abnormalitiy in one of the parents (sometimes in both) of children placed in his care for its correction. Its embryonic origin undoubtedly favors transmission by heredity. In his index of 500 cases an abnormal frenum of the upper lip occurred 39 times and in only one of these was the frenum of the lower lip similarly affected. Ketcham's investigations with the x-ray demonstrated that such maldevelopments in

the upper jaw are not related to an opening of the maxillary suture. Deficiency of number and size of one, or both, upper lateral incisors is quite frequently found in malocclusions of this type.

COMPLEX NEUTROCLUSIONS.

Cases belonging to this group differ from the foregoing in that they are more complicated. In many instances the patients are older, more teeth are involved and the deviations have become more firmly established.

(A) NEUTROCLUSION COMPLICATED BY ANOMALIES OF NUMBER.

In Fig. 47 a case of neutroclusion complicated by deficiency of number is

Fig. 46.—An incipient neutroclusion at seven years; compare with Fig. 45.

shown. The patient is a girl eight years old and presents an abnormal development of the frenum of the upper lip. The teeth were not affected by caries and the child's general physique was of normal development. In obtaining her history, the removal of adenoids at six and eight years was related. The rhinologist who referred the patient volunteered the information that while treating the father for a chronic nasal affection a premarital lues was admitted. On examination I found his denture not only normal, but ideal in every respect. The mother of the child, on the other hand, had no upper lateral incisors. Radiographs of the child's intermaxillary were therefore advised and they revealed the absence of the permanent lateral incisors (Fig. 48). The arrest of

development about the roots of the upper central incisors was very marked and the missing laterals complicated matters considerably. The upper lip was also in malrelation, presenting a flat, "window-shade" appearance.

It is probably of interest to note that the child's teeth are of a light shade, eye color bluish gray, complexion fair and hair color very light brown—in every instance like the mother. The father's teeth are of a dark yellow shade and much shorter mold, eye color very dark brown, complexion dark and hair black. Hence we ask: "Was the syphilis of the father the cause of the re-

Fig. 47.—Neutroclusion complicated by deficiency of number and facial deformity; age eight years.

Fig. 48.—Radiograph of Fig. 47.

cessive tendency of all paternal characteristics and the dominance of the maternal, including the deficiency of number in her teeth?"

The relative frequency of anomalies of number in either the temporary or permanent teeth is unknown, though their causal relation to malocclusions is quite generally recognized. According to Busch, there are three kinds of supernumerary teeth: (a) those with conical crowns and roots; (b) tubercles; and (c) supplemental teeth, or those of normal form (Hollander). Premature extraction of a temporary molar, or other traumatic influences, might

occasionally be responsible for a deficiency in the permanent series, but it is obvious that most anomalies of number are not due to extraneous causes. Atavism has long been regarded as a cause of redundancy; and more recently, their budding off from the common dental lamina has been suggested as a probable explanation of supernumerary teeth. But according to Tomes, "our present knowledge of the subject will not enable us to recognize the cause which

Fig. 49.—Neutroclusion complicated by labioversion of 2,|1, 2, facial deformity and perversion of 1| due to a supernumerary tooth.

Fig. 50.—Radiograph of case shown in Fig. 49.

has produced" anomalies in the number of teeth, though syphilis, rickets and other maladies have frequently been mentioned.

McQuillen, Tomes, and many other investigators have recorded numerous cases where anomalies of number were transmitted through several generations of the same family. In Fig. 49 the models of a patient 9 years old are shown which exhibit marked labioversion of three upper incisor teeth and tardy eruption of the *right* upper central incisor. The child was an only daughter and her parents were worried about the consequent facial deformity. They also

felt certain that the delayed eruption of the central incisors was abnormal and hence came in consultation. A hard mass could plainly be felt underneath the gum, which gave assurance that the central incisor was only impacted. The father then related the following: he had a similar "space" on his *left* upper side until his seventeenth year, when two teeth erupted simultaneously, one

Fig. 51.—Neutroclusion complicated by perversion, deficiency and redundancy.

Fig. 52.—Radiograph of Fig. 51.

Fig. 53.—Radiograph of Fig. 51.

considerably lingual to normal. A radiograph was now advised and the result is clearly shown in Fig. 50. In the opinion of the writer, this oral deformity could very appropriately be expressed as follows: *Neutroclusion* complicated by labioversion of 2|1, 2, facial deformity and perversion of 1|, due to a supernumerary tooth.

Anomalies of number like that in Fig. 49 are not due to extraneous influences; they may in truth be said to be the result of intrinsic factors; in all probability they are transmitted from parents to offspring by the germ cells.

In Fig. 51 a case of neutroclusion complicated by perversion of $\frac{3}{2}|$ deficiency of 2| and a dentigerous cyst containing three small supernumerary teeth is shown. The radiographs are shown in Figs. 52 and 53. The patient is a young miss of fifteen years whose older brother was treated some years ago for a malocclusion. Her general health and development are above the normal for her age. In such instances it is not always possible to procure an accurrate history and thus trace the transmission of the anomaly through several generations.

Fig. 54.—Neutroclusion complicated by anomalies of form.

(B) NEUTROCLUSION COMPLICATED BY ANOMALIES OF FORM.

Though rarely met with anomalies of form occasionally complicate malocclusions of the teeth. They suggest interesting morphological questions and may be classified into deficiency, or redundancy, of form and dichotomes. In the anterior teeth they usually present a disfigurement exceedingly difficult, if not impossible, to correct and frequently cause malocclusion of the adjoining teeth. Fig. 54 shows the models of a boy's denture at nine years complicated by dichotomes and deficiency of number. The malocclusion is of the neutroclusion type.

(C) NEUTROCLUSION COMPLICATED BY EXTREME ANOMALIES OF POSITION.

Extreme anomalies of position are relatively very common though their frequency is unknown, and they are found as complications in practically every type, or class, of dentofacial deformity. The causes are readily understood in some cases, but in others they remain obscure. The premature loss of temporary and permanent teeth are universally accepted as causative factors. In Fig. 55 the denture of a boy twelve years old is illustrated. The reader will note an extreme mesio-version of the upper, first permanent molars. The upper, first bicuspids are slightly in distoversion and the second bicuspids in perversion. Fig. 56 shows the radiographs of the right and left side of this denture and the impacted second bicuspids are revealed therein. The tem-

porary teeth of this child were extensively affected by caries and the deciduous molars were lost early. This permitted the mesial movement of the erupting first permanent molars and the impaction of the second bicuspids. In many cases this occurs only on one side of the mouth, and in others the first and second bicuspids also shift mesially, thus encroaching on the cuspid spaces. The latter in such instances, because they erupt considerably later, are usually in labioversion.

Fig. 55.—Neutroclusion complicated by mesioversion of 6|6 and perversion of 5|5.

Fig. 56.—Radiographs of Fig. 55.

In Fig. 57 the models of a boy fourteen years old show a neutroclusion complicated by mesioversion of the upper bicuspids and molars on both sides. Some practitioners would probably diagnose this case as a bilateral distoclusion, but the writer confidently believes that the profile should be taken into consideration (Fig. 58). We must also consider the perfectly formed lower arch and well developed chin. Furthermore, it is easily conceivable that if the deciduous second, upper molars were lost prematurely, the first, permanent molars might readily shift into a mesioversion at from six to eight years. The

bicuspids may subsequently follow the lines of least resistance if the temporary first molars and cuspids are lost prematurely and the permanent cuspids will thus erupt as shown in the illustration.

Fig. 57.—Neutroclusion complicated by mesioversion of 7, 6, 5, 4|4, 5, 6, 7

Fig. 58.—Facial form of Fig. 57.

Occasionally an arrest of development will be limited to a lateral half of one jaw and the result is a very asymmetrical deformity (Fig. 59). The models were made from the denture of a boy nine years old and the oral deformity

was complicated by nasal obstruction (due to adenoids), impairment of the voice, mouth breathing, abnormal frenum of the upper lip and facial deformity.

In other instances both sides of the upper arch may be in complete linguoversion, but if provided with adequate treatment during the period of tooth eruption a normal development may readily be obtained. On the other hand, if treatment is not provided during the developmental period the arrest in development may become very marked and involve the jaw bones beyond the alveolar structures.

In Fig. 60 a rare form of transversion of the |2, 3 is shown. The patient was a girl of sixteen years with normal general and oral health and the history entirely negative, except that her nasal passages had been treated by a rhinologist since her twelfth year. Her parents presented normal dentures, though a younger brother and sister have been under treatment for bilateral distoclusion. Each of the latter had an adenectomy performed before orthodontic treatment was instituted. An older brother and sister, on the other hand, have perfectly normal dentures.

Fig. 59.—Neutroclusion complicated by linguoversion of 6, V, IV, III, II|.

Extreme malpositions like Fig. 60 cannot be adequately expressed by the terms mesioversion and distoversion, hence the term *transversion*.

(D) PRINCIPAL FACIAL TYPES OF NEUTROCLUSION.

As intimated in the beginning, the class of oral deformities under consider-

ation embraces a large variety of anomalous dental and facial types; and the abnormal facial features met with differ not only in the degree of their deformity, but also in kind. A further division is therefore eminently desirable, though in the present stage of our knowledge it can be only a very rough outline at best. If we had at least 1000 case histories compiled of each of the following types, we might then speak with a fair degree of authority. But since there are no such records in existence, the first step would seem to be to draught at least the first line of the chart. Furthermore, in all previous classifications and diagnostic terminologies the underlying structural changes and

Fig. 60.—Neutroclusion complicated by transversion of |2 and 3.

disturbances of function were never sufficiently emphasized, which seriously hindered easy comprehension.

Neutroclusion complicated by linguoversion of the upper incisors is a common type (Fig. 61). The models were made from the denture of a boy eleven years old. His general health at that time was good, though the deciduous molars were extensively decayed. (These were extracted immediately after the impressions were taken.) As a child, he had contracted the usual infectious diseases like scarlet fever and diptheria, and at eight years adenoids were removed by a rhinologist.

The facial form of this case of malocclusion is shown in Fig. 62, which may well serve as a pattern, or archtype, because it is not extreme. The sunken

Fig. 61.—Neutroclusion complicated by linguoversion of the upper incisors, age eleven.

Fig. 62.—Facial deformity of case shown in Fig. 61

Fig. 63.—Same type as Figs. 61 and 62, age thirteen.

Fig. 64.—Neutroclusion complicated by linguoversion of the anterior teeth, age twelve.

naso-labial sulcus, owing to an arrest of development in the osseous structures underneath; the malposition of the angle of the mouth, the malrelation of the lips and their abnormal functions, which tend toward malformation; the flattened, straight upper lip, and seemingly prominent, large lower lip, are all readily recognized.

Malocclusions of this type usually present marked arrest of development in the intermaxillary bone, and the entire alveolar arch surrounding the upper teeth. Nasal obstruction is nearly always associated with this type and the impairment in the articulation is never entirely corrected by the rhinologist, no matter how successfully the adenectomy is performed. The effect in this respect of a successful orthodontic treatment is always gratifying.

There are many variations in the degree of deformity found in this type, as may readily be understood, but lack of space forbids our showing more than one other case (Fig. 63). The patient, a girl, was thirteen years old when the models were made and shows an advance in the number of permanent

Fig. 65.—Facial deformity of case shown in Fig. 64.

teeth erupted at that time when compared with Fig. 61. Two more years of delay tell the same old story—conditions have become more complex.

For the benefit of beginners, who have not yet mastered orthodontic diagnosis, it may not be amiss to point out the similarity between the facial form of this type and that of *mesioclusion,* with which it is frequently confused.

Neutroclusion complicated by linguoversion of the anterior teeth (Fig. 64). The patient, a girl twelve years old, gave a negative history. There was no nasal obstruction present, and only a slight impairment of the voice was noticed. Several of the molar teeth have been affected by extensive caries, which was poorly treated with faulty fillings. A decided facial deformity was also present, as shown in Fig. 65. The bicuspids and first molars are in linguoversion and considerable arrest of development is evident in the alveolar process surrounding these teeth.

The facial deformity shown in Fig. 65 is typical of this group, which always exhibits a "sunken" or expressionless mouth. And in this particular case the chin, or symphysis, is unusually well developed, which at first gives one an impression of overdevelopment. But such is not the case because after correction (though the chin was not involved in the treatment) the facial expression was one of perfect harmony.

In Fig. 66 the models of a denture at nine years of age are shown which may serve as a type for an earlier stage of this deformity. This patient was an anemic girl, rather subnormal in development, but immune to caries. The

Fig. 66.—Same type as Fig. 64 at nine years.

linguoversion of all the incisors is clearly shown, as well as the partial obliteration of the spaces the permanent cuspids will require.

Neutroclusion complicated by labioversion of the upper incisors is probably the most common form of facial deformity found in this class. Fig. 67 shows an extreme case of this type at sixteen years. The patient was a miss who had always had access to the best dental service and had also been in the care of a competent orthodontist for five years. She was of a nervous temperament and had acquired the pernicious habit of biting the lower lip. This undoubtedly was largely responsible for the extreme labioversion of the upper incisors and

Fig. 67.—Neutroclusion complicated by labioversion of the upper incisors, female, age sixteen.

Fig. 68.—Facial deformity of case shown in Fig. 67.

linguoversion of the lower. The latter were readily involved because of the break in the continuity of the lower arch caused by deficiency of number in the lower right cuspid. The intermaxillary bone was arrested in development, the upper incisors occupied an extremely oblique position, the voice was impaired and the facial deformity was considerable (Fig. 68). The form, functions and relations of the lips were all abnormal.

Thumbsucking, nasal obstruction, the prolonged use of pacifiers, and lip biting are believed to be causative factors in these cases. Fig. 69, made from a boy nine years old, shows this type at an earlier period.

In Figs. 70 and 71 longitudinal sections of the normal mouth are shown which illustrate the form and function of all the structural elements, especially of the teeth and closely related tissues. Special attention is called to the perfect adaptation of the dorsum of the tongue to the vault of the palate. In Figs. 72 and 73 similar sections of the abnormal mouth of the type under consideration are shown, which illustrate the perverted form and function and

Fig. 69.—Same type as Fig. 67 at nine years.

maladaptation of the teeth, lips, tongue and other contiguous structures. Special attention is directed to the abnormal functions and relations of the lips and tongue.

When we ponder the injury to the individual suffering from such malformations during the tender, developmental period of life, and reflect over their relative frequency, we feel impelled to urge the most painstaking investigations.

Neutroclusion complicated by infraversion of the anterior teeth (Fig. 74) is a form of abnormality of rather infrequent occurrence; but infraversion is a complication found in all classes of malocclusion. The models shown in the illustration were made from the teeth of a girl sixteen years old. The patient was referred by a rhinologist who had recently removed adenoids from her nasal passages. Her speech was very much impaired and she presented an unusually large tongue, which she was in the habit of "nursing." Hypertrophied turbinates, mouthbreathing and an enlarged uvula were also present, though her general and oral health was good. The alveolar process and the support-

Fig. 70.—Longitudinal section of a normal mouth.

Fig. 71.—Longitudinal section of a normal mouth.

ing osseous structures beyond are poorly developed in these cases. The facial expression is indicated in Fig. 75.

Neutroclusion complicated by labioversion of the upper and lower anterior teeth constitutes another, though very rare, variation, Fig. 76. Indeed it is an open question in these cases whether it is merely a labioversion of the anterior teeth, an arrest of development in both jaws (micrognathia), or an overdevelop-

Fig. 72.—Longitudinal section of a case of neutroculsion complicated by labioversion of the upper incisors.

Fig. 73.—Longitudinal section showing arrest of development in malocclusion.

ment in the size of the teeth (macrodontia), or a combination of these. More extreme conditions of this type will be shown in a subsequent number.

(E) CLINICAL SUMMARY.

SIMPLE NEUTROCLUSION.—*Etiology*:—Faulty diet, dental caries, premature loss of teeth, prolonged retention of temporary and supernumerary teeth, nasal stenosis, habits, traumatism, abnormal frena of the lips, idiopathic.

Pathology.—Malposition and malocclusion of the teeth, abnormal arch-

Fig 74.—Neutroclusion complicated by infraversion of the anterior teeth, age sixteen.

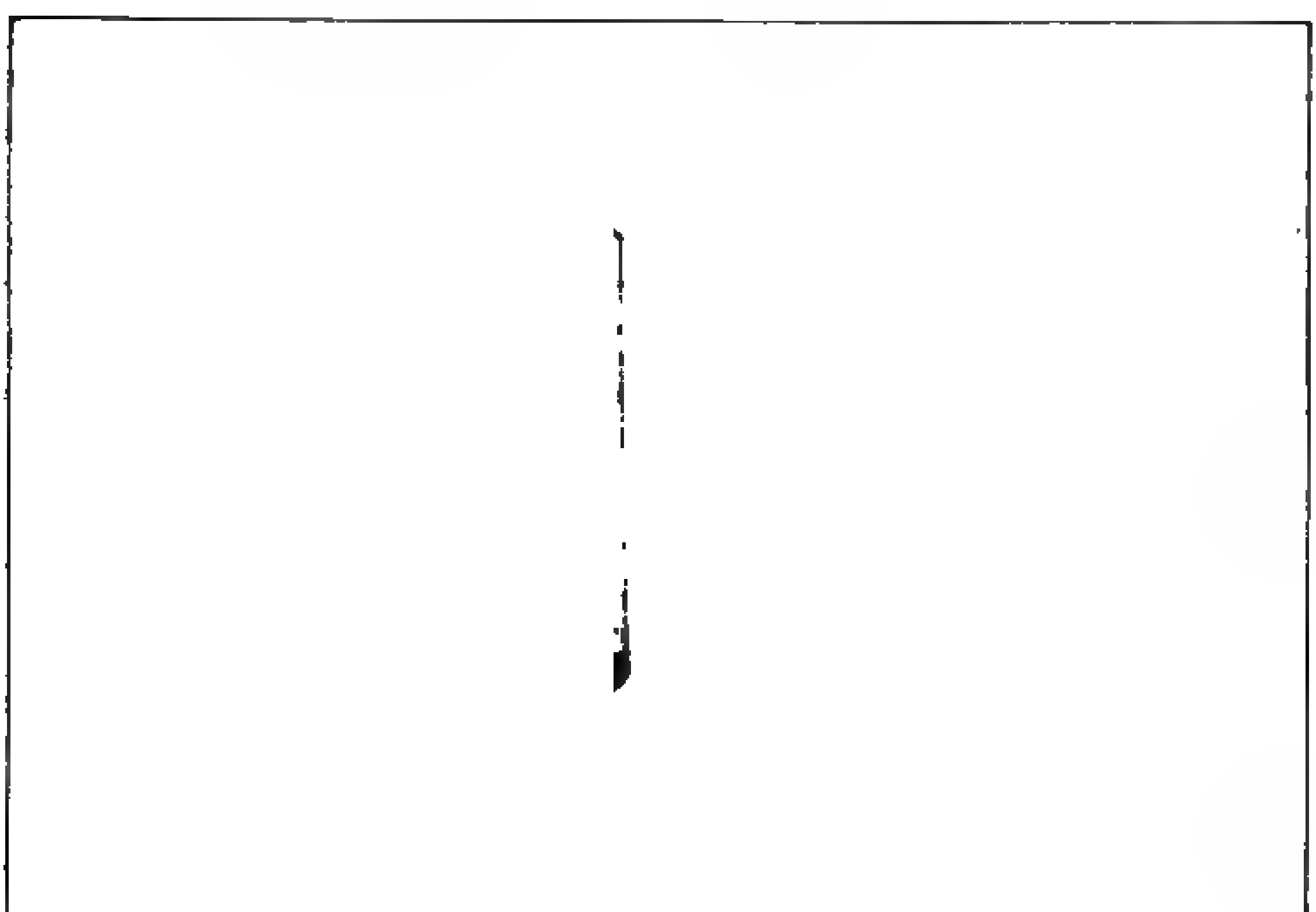


Fig. 75.—Facial deformity of neutroclusion complicated by infraversion of anterior teeth.

form, maldevelopment of the alveolar process, abnormal frena of the lips, anomalies of eruption, dental caries, nasal stenosis.

Prognosis.—Rarely favorable, depending on etiology and pathology; general tendency in most instances toward complications. Occasionally, postponement of treatment to ninth year permissible, but observation and control during the interim always advisable.

Complex Neutroclusion.—*Etiology.*—Faulty diet, dental caries, premature loss of teeth, prolonged retention of temporary and supernumerary teeth, nasal stenosis, habits, traumatism, anomalies of number, form and eruption of the teeth, idiopathic.

Pathology.—Malposition and malocclusion of the teeth, abnormal arch-

Fig. 76.—Facial type of neutroclusion complicated by labioversion of the upper and lower anterior teeth.

form, maldevelopment of the alveolar process, abnormal frena of the lips, anomalies of eruption, form and number of the teeth, dental caries, nasal stenosis, faulty articulation in speech, facial deformity.

Prognosis.—Always unfavorable, progressive, with frequent marked tendencies toward serious malformations of the osseous and facial structures; early treatment always advisable; postponement beyond the twelfth year extremely hazardous.

In conclusion, the author wishes to remind the reader that not all the complications of neutroclusion met with in practice are included above, but enough have been shown to emphasize the need of a rational, flexible terminology and to demonstrate the utter inadequacy of numerals. We need terms that will serve as guide posts to the imagination, that will promote easy comprehension

and thus elaborate thoughts, ideas, and feelings. In fine, the subject matter of the art and science of orthodontics is more than mere mechanics and malocclusion of the teeth. Dentofacial deformities constitute a large group of malformations due to errors of development, whose etiology, prognosis, pathological anatomy and pathological physiology are as yet very imperfectly understood. And though we revere the many contributions of the pioneers on this subject, we are not unmindful of present duties, or of the greater tasks in the future. All that has thus far been accomplished is but a faint beginning, a ray of light on the eastern hills of the dawn.

(To be continued.)

HISTOLOGICAL STUDIES OF THE DEVELOPMENT OF THE CEMENTUM OF THE ROOT OF THE TOOTH OF YOUNG RHESUS MONKEYS

By F. Hecker, B.S., D.D.S., A.M., M.D., Kansas City, Mo.

Director of Research Laboratory of the Dewey School of Orthodontia, Kansas City, Mo.

On making an examination of the literature relative to the origin of the cementum of the root of the tooth, we learn that the present teaching is that this tissue is laid down on the root of the tooth by the alveolar dental ligament. If the development of the cementum were dependent on the alveolar dental ligament, we would find in the substance of the fibrous capsule (which eventually becomes the alveolar dental ligament) in the immediate vicinity of its contact with the developing root of the tooth which it surrounds, cells or groups of cells which morphologically correspond to the cemental cells found in the apical area of the developing root in which the odontoblasts are commencing to arrange themselves. The alveolar dental ligament histologically is the same as the periosteum. The periosteum has by recent investigation been proved a limiting membrane for the growth of the bone; likewise, the author believes the alveolar dental ligament is a limiting membrane for the growth of the cementum. In a recent paper by the author, published in the *International Journal of Orthodontia, Vol. II., No.* 10, entitled, "Histological Studies of the Development of the Alveolus of Young Rhesus Monkeys," the present teaching that the development of the alveolus is dependent on the periosteum is not substantiated.

In this paper the author will endeavor to show that the cementum is not laid down on the root of the tooth by the fibrous capsule which surrounds the developing root of the tooth, but instead, that this tissue is laid down by the tooth pulp.

A study of slides made from the mandible and the maxillæ of young rhesus monkeys present microscopic evidence which does not coincide with the present teaching. But instead shows that cementum of the root of the tooth

is laid down by the tooth pulp before the dentine is laid down. To present this evidence the author has made photomicrographs from the slides studied, which will be explained histologically.

Let us now commence a study of the photomicrographs. The first picture

Fig. 1.—A low power picture at the apical area of the developing root of the young rhesus monkey.

Fig. 2.—Showing a higher magnification of an area in the same field as Fig. 1.

shown is the low magnification of the developing root near the apical area. Beginning at 1, which is the tooth pulp of the developing root of the tooth, advancing to 2, we observe the odontoblasts. At 3 is shown a space in which small cells are present. These cells are the cemental cells: continuing to 4,

we note that the dentine is now absent and that the odontoblasts are commencing to take their typical arrangement. At 5 is shown the cemental area. The cemental cells are faintly shown. Directly below 5 is shown the fibrous capsule, 6, which surrounds the developing root of the tooth.

The layer of cemental cells shown at 5 is termed by the author, the basel layer of the cementum, and it is from this layer that the future cemental lamellæ develop. The fibers of the fibrous capsule at this time of the development of the root of the tooth run parallel to it. If the cementum had its origin in the fibrous capsule there would be present in its substance in the immediate vicinity of its point of contact with the tooth, cells which morphologically are the same as the cells noted at 5. The evidence presented by this picture refutes the present teaching, as to the origin of the cementum. The next picture (Fig. 2) is a higher magnification of an area in the same field as shown in

Fig. 3.—Low power magnification of the developing root near the point of bifurcation.

Fig. 1. Beginning at 1, which is the tooth pulp, advance to 2, at which point the odontoblasts are shown. Directly below the odontoblasts at 3 is shown the cemental area of the developing root of the tooth. The upper portion of the cemental area is very dense, this density being caused by the cemental cells.

Directly opposite the end of the pointing line for this area, one will, on careful examination, observe a cemental cell. Comparing the cell thus shown to the odontoblasts and mentally to the fibroblast, one finds that this cell morphologically does not correspond to either of the foregoing cells. Again we have evidence which does not coincide with the present teaching as to the origin of the cementum of the root of the tooth.

In the next picture (Fig. 3) is shown an area of a developing root a short distance below the point of bifurcation. At 1 is shown the fibrous capsule which surrounds the developing root of the tooth; at 2, the dentine; at 3, the odontoblasts; and at 4, the cemental cells. Careful examination of the picture

shows that the cemental cells are more numerous below the pointing line than above it. The cemental cells, although not shown in contrast are sharp enough in outline to be easily distinguished from the fibroblasts in the substance of the

Fig 4.—Showing a low magnification of the buccal surface midway between the apical and gingival areas.

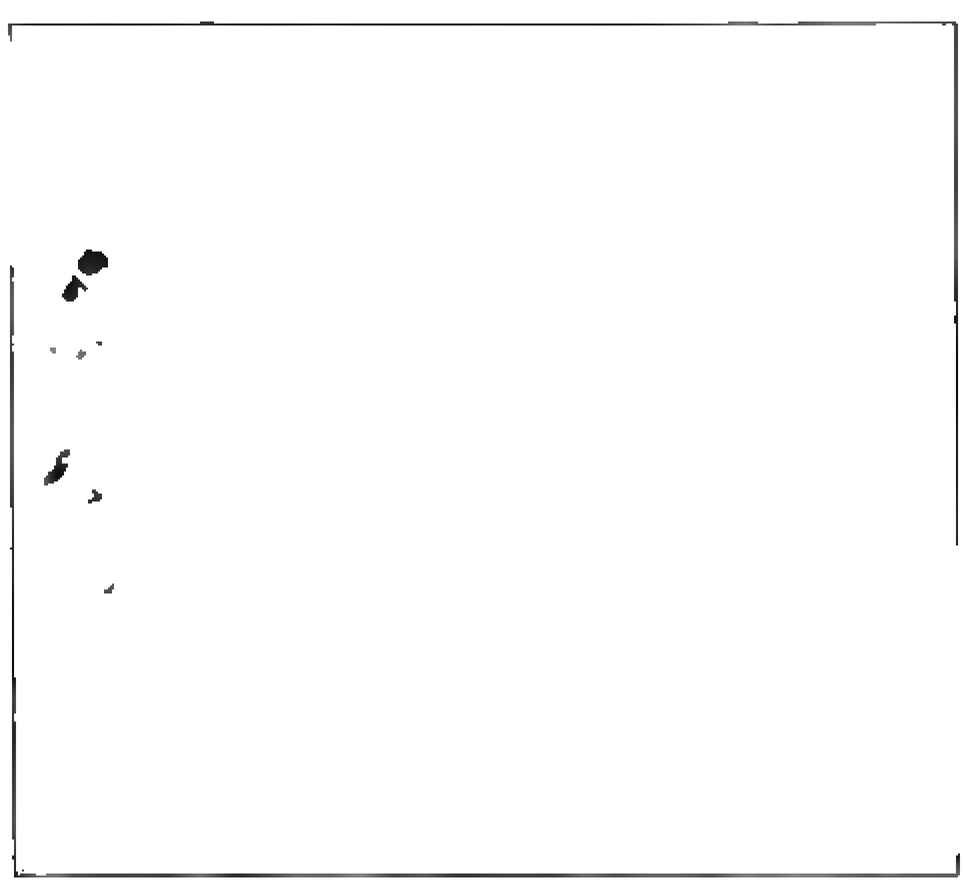


Fig. 5.—Showing a high magnification of an area in the same field as Fig. 4.

fibrous capsule. This picture shows that the cemental cells are not of a uniform size or shape but that they are laid down in layers or lamellæ at this time in the development of the root of the tooth.

The fibers of the fibrous capsule in this picture do not show any attach-

ment with the cementum of the root of the tooth. If the fibrous capsule were concerned in the development of the cementum, we would find in its substance in the immediate vicinity of its point of contact with the cemental area cells

Fig. 6.—Showing a higher magnification of an area at the extreme apical portion of a developing root.

Fig. 7.—Showing a higher magnification of an area from the same field as shown in Fig. 6.

which morphologically correspond to the cemental cells found near the dentine. We would also find that some cells, cemental in type would be found between fibers which had partially attached themselves to the root of the tooth. The evidence presented by this picture is directly against the present teaching.

The next picture (Fig. 4) is the buccal surface of the developing root of the tooth and is taken midway between the apical area and the gingival area. Beginning at 1, we observe the cemental cells: their arrangement is not regular, nor are they uniform in shape and in size. Only one layer of the cemental cells is shown in this picture. The reason that no more are shown is that no two layers are in the same plane when the fine adjustment of the microscope is employed. Hence the reason why only one layer or lamellæ of cemental cells is shown.

At 2 is shown the dentine; at 3, the odontoblasts; and at 4, the fibrous capsule which is cut longitudinally. In this picture we also observe that the fibers of the fibrous capsules are running parallel to the long axis of the developing root, no attachment of the fibers of the fibrous capsule being apparent.

Fig. 6.—Showing a canal in the substance of the cementum of the deciduous tooth of the rhesus monkey which the author believes is an Haversian canal.

The next picture (Fig. 5) is a higher magnification of an area of the same field as shown in Fig. 4. Beginning at 1 is shown the fibrous capsule; at 2, the cemental cells; and at 3, the dentine. On careful examination of the cemental border of the dentine we note that it is very rough and irregular in outline, and that the cemental cells are in close contact with the dentine. Continuing towards 4 we note the odontoblasts, and at 5 is shown the fibroblasts of the fibrous capsule.

This picture shows that the general direction of the fibrous capsule surrounding the developing root of the tooth is parallel to the long axis of the root. In this picture we are offered an excellent opportunity to study morphology of the cementum cell and the fibroblast. The cemental cell, we observe, is round at this time of the development of the root while the fibroblast is an elongated cell, the ends of which are tapered to a point, while the middle of

the cell is bulged. No apparent attachment of the fibers of the fibrous capsule to the root of the tooth is noticed.

The next picture (Fig. 6) is a low power picture taken from the extreme apical area of the developing root of the tooth. Beginning at 1, which is the tooth pulp, and advancing to 2, we at once note that the cells in the area indicated by the pointing line show that they are commencing to take on the arrangement of the odontoblast. At 3, the cells have now taken on a perpendicular position. At 4, we note that the arrangement of the cells is not the same as observed at 3, and further, that the cells are of a different kind than shown at 3. At 4, we note that the cells have now taken on a definite arrangement which is in layers or lamellæ. Further study shows that the cells are morphologically different. The cemental cells being round while the odontoblasts are cylindrically shaped. One can by careful observation trace

Fig. 9.—Showing lacunæ and canaliculæ of bone.

the transitional changes in shape and position, the odontoblasts, and the cemental cells, if one begins at 3 and advances towards 5 for the odontoblasts, and from 4 to 4′ to 6 for the cemental cells. At 5, are shown the odontoblasts and in this area they have taken their typical position. At 6, we observe the lamellæ of the cementum, and on comparison, we learn that the cemental cells are round, while the odontoblasts are cylindrical in shape. At 7, is shown the fibrous capsule which surrounds the developing root of the tooth. With this picture one is able to trace the transitional changes of the tooth pulp cell to the cemental cell and the odontoblast, and further one is able to show that the cemental cell is laid down before the odontoblast is at 4 and 4′, in which area the odontoblasts are just beginning to arrange themselves while the cemental show their position very distinctly.

The next picture (Fig. 7) is a high magnification of an area of the same field as shown by Fig. 6. Beginning at 1, which is the tooth pulp, advance to

2, which shows the odontoblasts. At 3, is shown the cemental area. In this area we observe that the cemental cells are laid down in lamellæ. At 4, is shown the fibrous capsule. In this picture we have further evidence that the cementum of the root of the tooth is laid down by tooth pulp.

In the next photograph (Fig. 8) is shown an area from the deciduous root in the rhesus monkey. The cementum of the root of the tooth is shown at 1. At 2 is shown a canal in the substance of the cementum which has a definite circumscribed wall and around this canal we find cemental lacunas, 3. The author has in his collection of slides a section from a human tooth in which there is also shown a canal in the substance of the cementum. The question which now arises is: "Why is it that these canals are not constantly found in the cementum?" The question can be answered as follows: In the process of embedding and placing the specimen to be cut, the angle of

Fig. 10.—Showing the lacunæ and canaliculæ of the cementum.

the specimen is such that the canals contained in the cementum are not in the plane of the specimen and, therefore, are not found. One cannot deny that the canal shown in this picture is not a nutrient canal of the cementum. This being the case we are compelled to admit that the canal shown is an Haversian canal, and with this admission we are compelled to admit that the cementum found around the root of a tooth is true bone. At 4 is shown the alveolar dental ligament, and at 5 the alveolus.

Fig. 9 is shown a high magnification of bone showing the lacunæ and the canaliculæ. Careful examination of this picture shows that the lucanæ and canaliculæ, 1, 2, 3, 4, and 5, all communicate with each other.

Fig. 10 shows a highly magnified area of the cementum of the root of the tooth. In this picture it is clearly shown that the lacunæ and the canaliculæ of the cementum, 1, 2, 3, and 4, all communicate with each other. Morphologically the cells of the cementum and of the bone are the same.

The evidence thus presented by the foregoing photomicrographs does not coincide with the present teaching that the cementum is laid down on the root of the tooth by the alveolar dental ligament, but instead, proves that this limited bony covering is developed from the tooth pulp before the dentine is laid down. Further, this limited bony covering of the root of the tooth histologically at high magnifications shows that the lacunæ of the cementum and of the bone are morphologically the same, and that the bony covering of the root of the tooth is true bone because of the presence of a canal contained in its substance which the author believes is a nutrient canal and, therefore, an Haversian canal.

THE HISTORY OF ORTHODONTIA

By Bernhard Wolf Weinberger, D.D.S., New York City.

(*Continued from page 571.*)

E. *BAKER*, in an article on *"The Use of India Rubber in Regulating Teeth," New York Dental Recorder,* Sept., 1846, page 15, says:

"Apparently there is no portion of the human system, which is subject to so much irregularity and sometimes deformity, as the teeth.

"It would undoubtedly be interesting to search, if possible, into the arcana of nature, and trace by what phenomena, or laws of physiology, there is such a variety of classes of irregularity in this respect, or to consider what effect civilization has had in contributing to it. Irregularity of teeth rarely or never occurs in savage, or semi-civilized life,—so it may be said of the brute creation.

"There is frequently a disproportion between the aggregate size of the teeth and the capacity of the jaw for their regular accommodation. No doubt a contraction of the jaw may be produced by the frequent and injudicious practice of prematurely extracting the deciduous teeth of children.

"The age of twelve years is generally recommended as the proper time to rectify irregularities in the permanent teeth.

"Due care should be taken that the superior and inferior dental arches should be preserved in their proper relative positions. As a general rule, when there is irregularity in the upper, there also is in the under teeth, and the regulating of both may be accomplished at the same time.

"What are the best means for bringing irregular teeth into their desired position, when traction or force is necessary in order to accomplish it? In reasoning on the subject, the question will naturally occur,—what application to a tooth will be most likely (there being room) to bring it to the particular and desired position? The answer will be, that power which is so applied as to draw the tooth directly and continually towards the position you wish it to occupy.

"A very slight continued pressure will be sufficient to regulate the teeth of young persons while the processes are comparatively soft and yielding.

"Caoutchouc, elastic gum, or India rubber, is admirably calculated to produce the desired effect in regulating teeth.

"No substance is yet known which is so pliable and at the same time so

elastic; and it is further a matter of curiosity, being capable of resisting the action of very powerful menstrua or solvents. Its solidity, flexibility and elasticity, and its quality of resisting the action of aqueous, spiritous, saline, oily, and other common solvents, render it extremely fit for the construction of tubes, catheters, ligatures and other instruments in which these properties are wanted.

"A narrow strip should be cut from a thin sheet of the India rubber, and after extending it to nearly its utmost capacity, without breaking, it should be fastened to the tooth to be regulated, and then be passed outside, or inside, as the case may require, of the tooth next to the one to be regulated, and which serves as a fulcrum, to draw or tract the irregular tooth to its proper position.

"Secondly, the ligature must be alternately shifted, when possible, to teeth each side of the irregular ones, but continually attached to the ones to be regulated, and for reasons which need no explanation. Thirdly, it should be so fastened to the teeth, as to do the least possible injury to the gums; and finally, it is generally necessary to have also a ligature fastened to the teeth in the opposite jaw, in order to rectify a corresponding irregularity frequently happening to the antagonistic teeth, or at any rate, to facilitate the operation on those teeth most out of place."

M. P. A. Grandhomme, a Frenchman, in an article in the *New York Dental Recorder,* November, 1846, page 29, entitled, *"Reflections Upon the Methods Made Use of at the Present Time for the Regulating of the Teeth, Followed by a Description of a New Process"* (translated by E. Baker), says:—

"First, on the means employed to the present day for the (reduction) regulating of teeth.

"The teeth, frequently, instead of rising vertically from the alveolar border, incline sometimes in variable angles, forwards, backwards, or sideways, so as to present the deformities, known under the names of anterior, posterior lateral obliquities, or obliquities, complicated or not with a movement of rotation on their axis.

"Praiseworthy efforts have been tried, with various success, to remedy these deviations and constitute thus a true dental orthopedy; but the results obtained to this time, have not been realized to the perfection desired and we have been left to deplore the insufficiency of our art, as it respects the correcting the irregularities of dentition.

"In alluding to the practice of the reduction of the irregularities of dentition, I introduce, with some confidence, a new process founded on the most rational theories, and sanctioned besides by an experience of many years, a process at once more powerful and more sure than any means made use of up to the present time.

"I propose to offer a few reflections, tending to show the inadequacy and imperfection of the means for this purpose, formerly made use of, which were:

"Sudden and instantaneous reduction, slow and gradual reduction.

"These are the two heads under which can be classed all operations, which are recommended, and commonly practiced for remedying the (obliquities) irregularities of the teeth, and of which we are going to make a most brief review, as our only object is (we do not conceal it), to prove their imperfections.

"First.—Instantaneous reduction, which is performed by the single process

of luxation, which I cite with regret, and which I shall not take the trouble of describing. The dangers to which such a process is liable render all criticism of it superfluous.

"Second.—Gradual reduction. It is to produce this that all the means generally employed, and also that which I propose to substitute, tend. This last is performed by two different methods, viz., traction and forcing back."

Although his work is interesting we gain little that is new, in that he was opposed to the methods then in practice, condemning all methods that were in use at that time, and advocating nothing that was new. He made use of caoutchouc, a material he says he was the first to introduce to the profession.

The apparatus used and described by him was a "band consisting of a narrow metallic plate fixed at its extremities to the molar teeth, by means of hooks and ligatures, and bent over the dental arch, passing over the dental obliquity; forming thus, a kind of bridge. Holes are pierced through the band opposite to the irregular tooth, and through them a ligature is attached to it: viz., the tooth, and renewed or tightened once in three or four days.

"The band then, ought to be classed among the passive agents. Its action is intermittent like that of the ligature and the problem of continued traction has not yet been solved. Besides, it has, though in a less degree, all the inconveniences of the simple ligature: inflammation of the gums and alveoli-dental periosteum, suppuration; loosening of the teeth, which become projecting; pains, fetid breath also follows its use, when it is continued a certain time.

"The band is liable to the same objection as all kinds of apparatus composed of several metals, or of gold of low standard, and which must be used to give the band the requisite consistency, acting like a galvanic battery in the mouth, the deplorable effects of which have not been sufficiently attended to by dentists, but are too well known by many persons who have suffered from them.

"The electro-chemical agents in question are not solely confined to the senses, they produce the additional result of decompositions, which extend to the dental tissues themselves. I merely allude to this fact, for the purpose of drawing the attention in a special work.

"The principal piece, is an envelope of Hippopotamus tooth, which is fitted to the jaw, embracing it in the whole extent, adjusted to all the sinuosities; penetrating as far as possible into the interstice so as to embrace a large surface, in order to afford the greatest possible firmness and solidity to the supporting point of the active means for pressing back. The space which this apparatus forms, is considerably open above the misplaced teeth, which it leaves altogether uncovered and which are thus placed between the two blades as plates which serve as a base to the space itself. The blade or plate situated on the side opposite to the irregularity forms a transverse arch, one part advanced, of which the office is to paralyse the antagonistic effect of the lip or tongue by keeping these organs at a distance during the whole time of the operation; the other, is consequently placed in the same direction as the irregularity, that is to say, internally, if retroversion is to be effected; externally, if an eversion, producing a sort of apophysis(?) or artificial process of bone, pierced with holes, and hol-

lowed with a transverse groove on the dental face, which rises parallel with and has the same height and width of each tooth.

"The means of propulsion which I use, is caoutchouc (India rubber) previously subjected to a preparation, which increases its force and elasticity. This substance, cut to a suitable shape, furnishes me with straps which I stretch forcibly between my fingers until they become of a very slight thickness. Then I rub and insinuate them between the teeth or tooth which is to be reduced, and the eminence of the hippopotamus, taking care always to place them at the part corresponding to the summit of the crown of the tooth. The space ought to be so narrow that the caoutchouc can only be introduced with some difficulty, thus producing the desired compression. A thread placed in the opening indicated fills it firmly in this position, from which it would soon escape if left to itself.

"Mode of Action. First.—Reduction should be undertaken as early as possible.

"Second.—In case of anterior irregularity, the first thing to be done is to secure a place in the alveolar circle, for the teeth which we wish to bring back into line.

"Third.—In the making of the apparatus we must keep in mind the ulterior changes which the jaw has to undergo.

"Fourth.—We must be attentively prospectively to the two dental arches, in order that, in the new relation which opposite teeth will afterwards contract, the good effects of the operation may be maintained and confirmed.

"Fifth.—The apparatus should be made of hippopotamus, to guard against galvanic currents and to present a sufficient volume and a form which shall not be cumbersome or impel mastication.

"Sixth.—An essential condition of the successful application of the apparatus is that it shall incase the parts with such exactness as to render impossible the slightest occillation, and that on the other hand, it may be easily taken off so as to permit such frequency of cleaning and other hygienic attentions as are requisite for the health of the teeth and gums.

"Seventh.—The supporting points which the apparatus takes on the dental arch should be as extensive and regularly arranged as possible, in order to avoid unequal pressure, which is dangerous.

"Last.—The force applied to the reduction ought to be slow and continuous in its action."

W. H. Mortimer, in his *"Observations on the Growth and Irregularities of Children's Teeth,"* 1846, speaks on the "Irregularities of the teeth arising 'either from natural, or from accidental causes.' They may be termed natural—first, when they result from the jaw not expanding sufficiently to allow the teeth to form a regular circle; secondly, when they are larger than the ordinary dimensions; and thirdly, when they do not appear in their proper order and place.

"They may be termed accidental when caused by negligence or improper treatment at the time of their growth.

"Accidental irregularities are of four sorts.

"The first arises from neglect, or from ignorance in removing the milk-teeth too soon.

"The second is where the under teeth partially bite inside and partially outside of the upper.

"The third is when all the under teeth close outside instead of inside the upper ones (Fig. 1, No. 1). This is by far the most frightful of all irregularities, and is called 'under hung' (another improper term); for independently of throwing the chin forward, which gives to youth the appearance of old age, it considerably shortens the distance between the nose and chin, and completely spoils the harmony of the face.

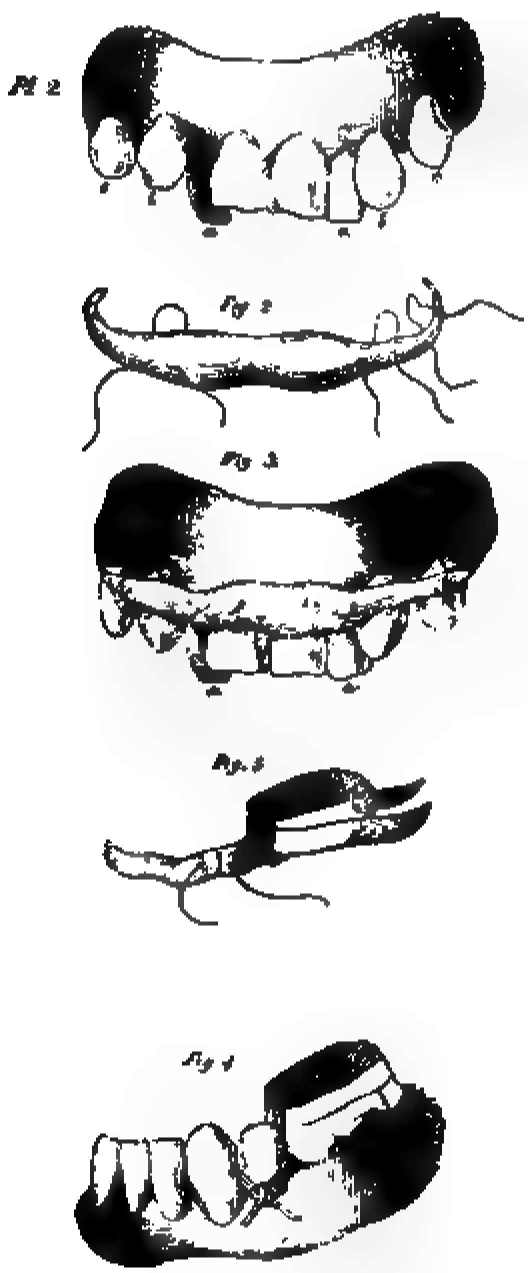


Fig. 1.—Appliance as used by W. H Mortimer.

Fig 2.—Type of incline gold plane as used by W. H. Mortimer.

"The fourth is when one or more of the upper teeth project considerably outwards and are separated.

"A gold plate (Fig. 1, No. 2) must be made, by means of a bronze model of the jaw, to fit close to all the teeth it covers, except those that are to be brought forward; between which and the gold plate there should be a considerable distance as much as if the lateral incisors were in their proper circle. It should extend from one grinder to another (*c, c*) and clasp round them. The plates should be made sufficiently thin to be elastic; but, as it is necessary that it should hold very firm on the teeth, it will be requisite to put a ligature on both sides, to keep it so. By a ligature, I mean that two holes are to be made in the plate (*b, b*) at

the part that covers the tooth to which it is to be fixed. The two ends of the ligature (which must be of strong silk) are then to be passed outwards through them, and a loop is to be left behind (Fig. 2. *b, b*) which is to be passed round the tooth; so that when the ligature is drawn tight and tied, the tooth may hold the plate firm to it. Before, therefore, we attempt to tie the teeth we wish to pull forwards, the plate must be tried and found correct; that is, fixed so firmly to the teeth, that no motion of the lips can move it.

"Holes should now be made, and ligatures put opposite the lateral incisors, and after the plate is fixed at the side, as before described, the ligatures before the lateral incisors (Fig. 1, No. 3 *aa*) are then to be tied as tight as possible, so as to have a constant strain on these teeth, and this will draw them imperceptibly forward to the plate. By the same means we shall accomplish our second intention; for the gold plate, pressing on the sides of the canine teeth, will push them towards the small grinders, and increase the required space for the lateral incisors *a, a.* Fig. 1, No. 3 represents the plate fixed to the teeth.

"We have now to prevent the under teeth from closing outside the upper. For this purpose, a gold plate must be made to cover one or more of the double teeth of the under jaw (Fig. 1, No. 4), and a band of the same metal should be continued on to the two next teeth (Fig. 1, No. 5), and made fast to one of the small grinders by a ligature (*c*). On the gold that covers the top of the double tooth, a piece of hippopotamus or sea-horse tooth should be fixed (*b*), sufficiently high to prevent the upper and lower teeth from touching each other when the jaw closes, and at the same time to serve as an artificial masticating surface for the patient to eat upon.

"In these cases, we must begin by making a gold band, to go inside all the under teeth (Fig. 2) and joined to a plate (*b, b*), that will cover the large grinders on each side. The band should fit close to the teeth at the sides, but not in the middle, so that we may be enabled to draw these in, if necessary. At each side, over the grinders, an artificial mastication surface should be made as directed in case 1. In the center (*s*) an inclined gold plane should come over the under teeth, so that every time the mouth closes, the upper teeth may strike against it, and be pushed outwards. Fig. 2, No. 3 shows the action of the plate upon them.

"If the operation gives no pain to the patient, the inclined plane may be made sufficiently large to cause the whole six front teeth of the upper jaw to strike together.

"The ligatures (*a, a*) are to hold the plate firm in the mouth; (*c, c*) are to draw in the under teeth if requisite."

J. S. Ware "Regulating Children's Teeth," New York Dental Recorder, August and September, 1848.

"Extracting of one or more teeth has been the general plan adopted when the teeth grow in an uneven and crowded position, and in a few cases this is all that may be necessary to secure a perfect dental arch, without narrowing.

"I make a thin gold plate (No. 30) to fit the arch of the superior jaw, and the inside of all the molar and bicuspid teeth, fastening it with clasps passing round the second bicuspid and sometimes round the first molars. It should be made to be worn with ease, and to be easily removed by the patient. The plate

should be stiffened by soldering a narrow piece of gold across the center. To the plate thus fitted to the roof of the mouth and teeth, I fasten pieces of gold of greater thickness than that which the plate is made of (No. 28) to correspond with each tooth which I wish to alter, and of the same width, and if the tooth is to be carried inwards, the plate of gold should be fastened the distance of one line from the tooth, and a ligature is to be attached to it, and to pass round the tooth to be pressed inwards. The ligatures may be made of floss silk, or India rubber; if floss silk is used it must be tightened every day—if India rubber, every third day will be sufficient.

"But when the teeth are to be carried outwards, the plate of gold should be fastened close to the teeth, and made long enough to project below their points, so that when the patient closes the mouth the teeth of the lower jaw will strike the back of the projecting plates of gold, which will force the teeth outwards. These plates of gold which correspond with the teeth to be changed in their position, must be altered from time to time, as the teeth are pressed outwards, so as to keep up a continued pressure upon them, until they are carried to the desired place, after which the plate should be worn at least three months so as to hold the teeth in their position until they become firmly fixed.

"Cases may occur where it will be found difficult to sustain the plate in its proper position. In such cases a piece of gold should be fastened to the plate inside of the first bicuspid, the shape of the capital letter L, projecting downward a little below the tooth or teeth so that the bicuspid of the under jaw will come in contact with the plate of gold before it does with any of the other teeth, this will effectually keep the plate from dropping. In cases where there is space sufficient, between the bicuspids to admit a thin plate of gold, I fasten a thimble to the plate instead of the piece of gold in the shape of the capital L which completely encircles the teeth, and forms a very firm standard for the under teeth to press against. If the bicuspids are to be pressed inwards, a ligature should be applied in the same manner as described above for the incisor teeth.

"The plate must be removed immediately after every meal, and faithfully cleaned. The teeth of the patient should also be brushed at the same time during the whole time of regulating, and a tonic astringent wash composed of tinctures of cinchona and catechu, equal parts, and tincture of myrrh, half a part, flavored with a few drops of oil of sassafras, will also assist much in hardening and strengthening the gums."

Jos. Engel in 1849, in *"Zeitschr. d. Ges. Aerzte."* endeavored to show that in children at birth, the angle of the lower jaw was between 135 and 140 degrees, that this angle changed as children developed, and in an adult was again similar to a child; that the position of the teeth shifted, were any of them missing, and that generally they moved forward, not backward, due to constant chewing and usage.

James D. White in the *"Dental News Letter"* for October, 1850, described the use of spiral springs in the regulating of teeth, a method both novel and new. This method was later modified by Thomas W. Evans.

"Accompanying this is an arrangement with bands and spiral springs, for enlarging the superior maxillary when it is contracted by premature extraction of the deciduous teeth, or any other cause, which I have used with success, in

many difficult cases for many years, as well for expanding the arch as the regulation of teeth. You will perceive that it is calculated to keep up an equal and perpetual pressure on as many teeth as is desirable. The accompanying model presents an interesting case, and illustrates what are, too often, two inexcusable

Fig. 3.—J. D. White.

errors of the past and present generations, and of daily occurrence. First, that of extracting the deciduous canine teeth, to give the lateral incisors room, as it is termed and which, as their unabsorbed fangs leave a deep wound, in healing draws the lateral incisors and first deciduous molars together, contracts the alve-

Fig. 4.—Spiral spring arch as used by J. D. White.

olar arch, and allows the laterals to fall backwards and inwards, dragging the lateral edges of the front incisors along with them and sometimes before they are long enough to grasp the inferior teeth, in advance, they are much behind them; and second, to mend the matter when the permanent canine teeth make their

appearance apparently too far outside of the arch, (it is true but a deformed arch) and only room for half a tooth between the laterals and bicuspids and in some instances none at all, either they, or the first molars, the most valuable teeth in the head, or the bicuspids, are doomed for extraction to make still more room instead of endeavoring to remedy by art that which ignorance has done, enlarge the arch and bring out the six or eight stray teeth to the canines which are in most cases in their proper places. The manner of making it is exceedingly simple; make a plaster model of the mouth in the usual way, then fit a light band around each tooth, joining each other at feather edges between the teeth, instead of filing between those that require to be thrown outwards. Say, for instance, it is the superior bicuspids on either side; solder those bands together on the palatine sides of the teeth, then solder a short piece of wire on the same sides of the bands near their middle, and thick enough to allow of slipping on a spiral spring long enough to extend from one side of the arch to the other, and to lie close along the posterior parts of the front teeth; now if those bands are nicely fitted around the teeth, the apparatus can be worn with comparative comfort; the patient can go to school, as it is generally in school days that the operation is required; or even into society without exposing so much gold as those horrible bars that go all around the front part of the teeth and gums. Another method for applying the spiral spring and which is original with myself, though I do not name it to claim any credit, is as follows:

"It often happens that the two lateral incisors are grasped posterior to the inferior teeth, and the front incisors are in their proper positions. By lashing down the extremities of a piece of spiral spring to the necks of the lateral incisors, and the spring extending across the two front incisors, you will perceive that they become a fulcrum for the spring to throw the laterals over the lower teeth. As the spring straightens, the laterals will be brought on a line with the central incisors. It is generally true, that, as the front teeth are harder to force backwards, on account of the alveolar process being thicker on that part than the external alveolar plate, and the teeth being large too that they afford sufficient fulcrumage. But if they be not, place a plate in the roof of the mouth, and fasten it to the back teeth, as if it were to set teeth, letting small pieces of plate project forward and downward against the posterior parts of the front teeth, which will prevent the possibility of their being pressed backwards.

"But if it be like several cases that I am now treating where the front teeth are too for out, by the time the laterals are well forward, the front will be depressed sufficiently. Or when the median edges of the front teeth present the appearance of bulging out, the spring pressing upon them will level them down properly. If the laterals be too long to sweep over the lower teeth solder to the plate, if there be one in the mouth, an inclined plane to keep the jaws apart far enough for that purpose. When the plate is not in, lash the incline plane to one or more of the teeth. Never put a cap on over a tooth to receive the direct or full stroke of the jaws in masticating. I have seen cases where the enamel has been literally smashed by that means. As many injuries have been sustained in various ways, in the treatment of irregularity of the teeth, many persons needing attention will not venture to submit to the operation. All cases require close watching that too much pressure is not produced so as not to

establish periosteal inflammation in teeth that are not fully developed. I use also the spiral spring for turning the teeth that stand across the alveolar ridge. There are a great variety of ways of applying those springs so as to make a very neat and comfortable apparatus for enlarging or contracting either of the maxillaries or for operating on a single tooth."

Fourth Period—Time of Harris to Farrar and Kingsley

Chapin Aaron Harris (1806-1860) was one of the most versatile and talented men in the dental profession; educator, journalist, author and organizer. He, with the able assistance of Horace H. Hayden, succeeded in elevating what was then dentistry, to a science. Their efforts resulted in the establishment of the Baltimore College of Dental Surgery, 1840, the first school for the education

Fig. 5.—Chapin Aaron Harris. (1806-60.)

of dentists; the organization of the American Society of Dental Surgeons, now the National Dental Association, in 1840, thus bringing together the few widely scattered dentists of his day so as to enable them to work more effectively in building up what was then a new profession. In order that the men who were devoting themselves to the care of teeth, might disseminate knowledge and professional news, he successfully brought out the first number of *"The American Journal of Dental Science"* in June, 1839, the first periodical journal devoted to dentistry.

Harris in his *"Principles and Practice of Dental Surgery"* says:

"In describing the treatment of irregularity, we shall notice the means by

which some of its principal varieties may be remedied; otherwise, the application of the principles of treatment would not be well understood, since it must be varied to suit each individual case.

"As a general rule, the sooner irregularity in the arrangement of the teeth is remedied the better, for the longer a tooth is allowed to occupy a wrong position, the more difficult will be its adjustment.

"The age of the subject, therefore, should always govern the practitioner in forming an opinion as to the practicability of removing irregularity.

"The first thing claiming attention in the treatment is the removal of its causes.

"When it is the result of narrowness of the jaw, either natural or acquired, a permanent tooth on either side should be removed to make room for such as are improperly situated.

Fig. 6.—Type of arch as used by Chapin A. Harris.

Fig. 7.—Gold caps and ligatures as used by Harris.

"Without going into a minute detail of the method adopted for procuring the appliance employed, it will be sufficient to refer the reader to Fig. 6. This represents a plaster model of the teeth, alveolar border, palatine arch, and the apparatus employed for remedying the deformity. The second bicuspids were first extracted, then, by means of ligatures applied to the second molars and first bicuspids, and made fast to a band of gold passing on the outside of the arch, which were renewed every day, these teeth were brought out to their proper position in eleven weeks; this done, there was a space of nearly an eighth of an inch between the cuspids and first bicuspids; this was filled up, by bringing back with ligatures, the former to the latter. A ligature was next applied to the right lateral, passed through a hole in the gold band in front, and made fast. In ten days this tooth was brought to its proper place. A ligature was now attached to a knob soldered on the gold plate behind the teeth on the inner side of the alveolar border for the purpose, and tied tightly in front of the projecting right central incisor. In about three weeks this was brought to a position along side the lateral incisor of the same side. The left central was then, in like manner, brought forward, and the left lateral carried backward to its proper place.

"A gold plate of the ordinary thickness should be swaged to fit the first and second molars, if the second has made its appearance, and if not, the second bicuspid and first molar on each side of the jaw, so as completely to incase these

teeth. If these caps are not thick enough to prevent the front teeth from coming together, a piece of gold plate may be soldered on that part of each which covers the grinding surfaces of the teeth, and having proceeded thus far, a small gold knob is soldered on each side of each cap, and to each of which a ligature of silk or gum elastic is attached. These ligatures are now brought forward and tied tightly around the cuspids. When thus adjusted, the lower arch will present the appearance exhibited in Fig. 7. By this means the cuspids may, in fifteen or twenty days, be taken back to the bicuspids; but, if in their progress they are not carried towards the inner part of the alveolar ridge, the outer ligatures may be left off after a few days, and the inner ones only employed, to complete the remainder of the operation.

"After the positions of the cuspids have been thus changed, the gold caps should be removed and a circular bar of gold, extending from one to the other, so constructed as to pass about a quarter of an inch behind the incisors, should now be soldered at each end of the inner side of each cap, and a hole made through it behind each of the incisors, through which a ligature of silk may be passed, and after it is placed in the mouth, it is brought forward and tied tightly in front of each tooth. These ligatures should be renewed every day until the teeth are carried far enough back to strike on the inside of the corresponding teeth in the upper jaw."

W. H. Allen in the *New York Dental Recorder,* March, 1850, in describing a number of *"Cases of Irregular Teeth,"* says:

"Having had several complicated and difficult cases of irregular teeth to treat in my practice, and having been solicited by professional friends to publish them in the *Recorder,* I have finally determined to give you, as near as I can, a description of a few of the most interesting, with my mode of treatment, and the success attending it, premising that I claim nothing particular new or meritorious in the methods pursued for reducing them to regularity.

"The second bicuspid was extracted from each side of the lower jaw and the teeth, one at a time drawn back into their natural position. This was effected by first fitting a gold band, with clasps attached to the anterior molars, passing round a little back of the teeth to be moved, and having a small ivory block attached on each side, for the antagonistic teeth to bite on, so as to permit the lower incisors to pass back under those of the upper jaw. From this band, ligatures of India rubber extended around each tooth requiring to be moved and soon brought them back to the gold band. It was necessary then to keep the apparatus on until the teeth became firmly set in their new position."

In another case we find the screw being again made use of, the irregularity was remedied in the following manner: "two caps with strong clasps attached were fitted to each anterior molar, and to these clasps a thick stiff piece of plate was attached, passing round in front of all the teeth. A nut attached to this screw, outside the plate tightened a little every day, soon brought the tooth forward into its proper position.

"The lateral incisor was brought into place by means of ligatures of India rubber attached to it, and tied in front of the plate. The plate was worn about three months, since which they have remained in a natural position, except that

the teeth are a little crowded, which might have been prevented if he had consented to the removal of the bicuspids as I advised."

Another method used by Allen was that, "A plate (*a*) was made to fit the roof of the mouth fastened by clasps (*b*) to the first molars; ligatures were attached to this plate, and tied round the laterals, by means of which they were soon reduced to their proper position. I then soldered the two ends of a gold plate –extending outside the teeth—to the clasps on either side. Bands of gold were fitted round each of the front incisors with a wire two lines long (*c*) projecting from the front side and passing through a slot in the outside plate; I then tied ligatures of India rubber from the ends of these wires to pins fastened in the outside plate, far back, near the clasps; these produced a rotary motion in the teeth which soon affected their regularity. (Fig. 8.)

"A plate of gold (see Fig. 9) following the palatine arch, which was very deep, from one side to the other, was affixed to the bicuspids of each side by clasps. This plate is so made, that when attached to the teeth, it should constantly press them and the alveolar process outward, towards the cheeks. To

Fig. 8.—Appliance of W. H. Allen.

Fig. 9—Another appliance of W. H. Allen.

keep up a constant outward pressure, two gold wires were attached to the plate with hinges at *A.A.* meeting and forming nearly a right angle at *B.* where was fastened a strip of caoutchouc, which, being passed between the median incisors, drawn tight, and fastened, produced the double effect of widening the palatine arch, and of pulling back the incisors, which projected too far by three or four lines. This apparatus was kept on and occasionally tightened, for several weeks, when in addition, I soldered each end of a thick gold plate, about three lines in width, and long enough to extend outside the teeth, from the bicuspids of one side to those of the other, to the clasps of the former plate. This passed outside of the teeth in a true and regular arch, and being pierced with holes opposite each tooth they were easily reduced to their proper position by means of ligatures of caoutchouc, carried round the teeth, and fastened outside the plate. This being done nothing remained, but to keep the teeth in their new positions, until they became firm, which necessarily occupied several weeks, on account of the complication of the irregularity.

"The inferior jaw was necessarily treated in a somewhat different manner, in consequence of the interposition of the tongue; the process was quite simple, however, and very effectual. Finding the first molar (*A*) of the left side too far

decayed to admit of being filled, I extracted it; the lateral incisor (*B*) of the right side was almost removed, on account of the crowded state of the teeth. A plate of gold (see Fig. 10) was then fastened by means of clasps, to the large molar of the right side; and to the second bicuspid of the left, which by its own elasticity, spread the teeth of each side sufficiently, in a few weeks. Holes being punched through this plate opposite each tooth, ligatures of caoutchouc were applied as upon the upper jaw, and kept on until the teeth assumed a position to antagonize properly with those in the upper jaw, and had become firm; the plates were then removed."

Wm. Lintott "Structure, Economy, and Pathology of the Human Teeth," in the *Dental News Letter*, 1852, p. 19, on *"Irregularity of the Teeth,"* says:

"The contour of the features depends essentially on the form of the jaws. A lofty forehead, expressive eyes, a well shaped nose, are most effective adjuncts; yet the character of the countenance, as a whole, will be especially influenced by the position of the lower, and the due expansion of the upper jaw. When it is understood how far this desirable conformation depends on the ar-

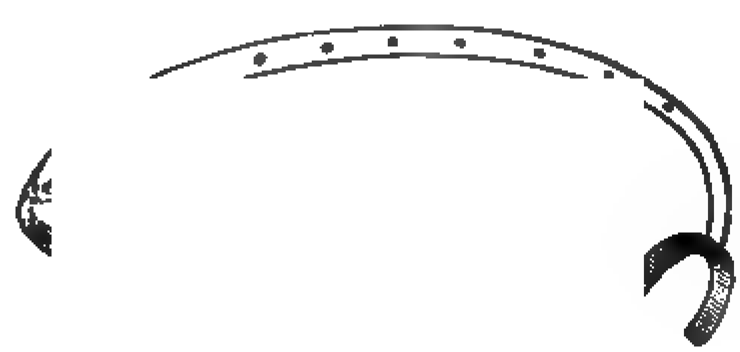


Fig. 10.—A type of arch used by W. H. Allen.

rangement of the teeth, a due importance will be at once attached to their progress, and the proper degree of watchfulness extended to them particularly as regards the fairer portion of creation.

"Deformity of the jaws may in almost every case be traced to an improper interruption of nature, in prematurely extracting the shedding-teeth. So long as man is content to follow nature, all will go well; but no sooner does he attempt to take the rein, than the mischievous effects of his interference become apparent.

"The process by which nature frees the jaws of the temporary teeth, when their presence is no longer required, is by the absorption of the fangs. By this action the crowns are deprived of all other support than that which the attachment of the gums affords, and consequently they will either come away themselves when pressed on by food, or will be detached easily by the fingers. Sometimes, however, the progress of absorption of the fangs of the shedding teeth is not commensurate with the growth of the permanent teeth, and the latter will thus be more or less diverted from their proper positions. For this reason it is requisite that the mouth should be frequently examined during the period of changing the teeth; and as soon as the point of the permanent tooth

pierces the gum or presses so hard against it as to be easily discoverable, then and not till then, should the temporary tooth, which is in the way be extracted. If parents would content themselves with ascertaining that no obstacles of this description exist, that the six upper front teeth shut just clear over and beyond the six lower, and would leave the rest of the operations of nature at least until the age of fourteen or fifteen, the frequency of irregular conformations of the mouth, and consequent deformity of the features, would be greatly diminished.

"There are, of course, some exceptions to this rule. Original malformation and contraction of the jaw bones may exist, and the size of the permanent teeth may be utterly disporportionate to the expansion of the maxillary arch. Supernumerary teeth may be formed, and pressing upon the others, may force them out of their true position, and produce a considerable degree of irregularity; and whenever it so happens that a front tooth of one jaw is, in closing the mouth, brought into irregular contact with another of the opposite jaw, one or both will be driven out of their proper position.

"An accurate model of both upper and lower jaw must be obtained, from which a casing or capping for the teeth of the lower jaw is to be stamped out of a thin plate of either gold or silver. The capping is to be continued from the first or second molar of one side round to the corresponding tooth of the other; it must fit closely over the grinding surface of the molars, where it must be rendered thick enough to prevent, by its interposition, the contact of the front teeth. The plate must overlap and fit closely also to the outer side of the molars, and be carried entirely down the inner side, and partly on the gum; over the canines and incisors, it must extend rather more than two-thirds down, inside and out—opposite the space between the necks of the molars, the plate is to be perforated, so as to permit the passage of one or more ligatures, which, tied around the necks of the teeth, secure the capping firmly in its place—on the ridge of the capping is soldered a thin plate of the metal, edge-wise, which must be smoothed gradually off. The whole apparatus being thus prepared, it only remains so to adjust the opposing edges of the capping and upper teeth, that when properly fixed, the edge of the capping shall, on closing the teeth, just slide inside that of each of the six upper front teeth.

"Another means is the employment of a light bar of gold or silver, passing round their front surface, by means of which they may be either drawn outwards or driven inwards as the nature of the irregularity may demand. The mode of preparing the bar, adjusting and securing it with sufficient firmness, is the same as for the capping already described, excepting that it requires to be fitted to the upper teeth only. The capping over the bicuspids, by which the closing of the teeth is to be prevented and the apparatus fastened, is to be carried well down their external surface, and to this part of the capping, a bar is to be soldered extending from the first bicuspid on one side round to the same tooth on the other. The inner face of the bar is to be modeled so as to fit closely and evenly to as many of the six front teeth as already stand so far forward as to come up to or beyond the desired position. If none of the teeth are thus far advanced, the bar must be made to describe exactly the line of the arch in which they ought to stand. Precisely opposite the center of each tooth which is to be brought out, a strong piece of similar metal must be soldered into the upper edge

of the bar; from these points ligatures of a material known as "Indian Twist" are to be passed round the necks of the irregular teeth, and drawn daily closer and closer, until the teeth, yielding to the constant pressure thus brought to bear on them, approach the bar and assume their proper position. When any one or more teeth project beyond the right line, and it is desired to move them inwards, a small hole must be drilled through the bar over against the most prominent point of each; a screw-thread is then to be cut, and a short screw introduced, which, working through the bar, will by a turn or two each day, keep up such a continued pressure against each tooth as will quickly force it back as desired. The projection of the screw-heads must not be so great as to cause annoyance to the lip; and longer screws must be kept ready for use, in order to reach the teeth as they recede from the bar."

It will hardly be amiss to include in this historical review of Orthodontic literature the report of the annual meeting of the *American Society of Dental Surgeons,* as found in the September number of the *Dental News Letter* of 1852. The action taken by the society and the remarks included in the paper by *Dr. Tucker,* fully illustrates the spirit of those early pioneers in orthodontia, the willingness to impart to the profession those facts that might tend to elevate the standard of the dental science, irrespective of remuneration and for the benefit of "a chosen few." How much further, and better off would orthodontia be, if this same feeling prevailed today.

"Dr. E. J. Tucker read a paper on the subject of *"Dental Irregularities,"* which was fruitful of instruction upon the subject treated, containing many hints of importance to the profession.

"On motion of Dr. Hullihen, of Wheeling, Va., voted a gold medal, of the value of $25.00 be awarded by this society for the best paper upon the cause and treatment of the irregularities of the teeth, to be read at the next annual meeting of this society."

E. Tucker, "On Irregularity of the Teeth," Dental News Letter, 1852, page 95:

"I did not consent with any conviction that I should render a service that might not be better given by others, but rather from a sense of duty that the humblest member of society owes to himself and to those with whom he may be associated, always to use at all times his best endeavors to do what he can to promote a common object.

"The American Dental Society was not, I presume to say, formed for the display of mere theoretical knowledge, but rather with a more utilitarian purpose, that of interchanging the practical results of a common experience and of communicating opinions without ceremony and without a spirit of rivalry, in regard to the vital interests of our profession. I speak only for myself—as you are all better acquainted with the opinions of others than I am. It will not be expected that I should tax you with any fragments of learning, knowing full well that where the whole is possessed the parts are not wanting.

"In speaking of the irregularity of the teeth, I claim your attention upon a subject which has an importance in itself, and which required rather the application of an ordinary knowledge, than any great exertion of genius. In the spirit of a praiseworthy ambition to discover new things, we are apt, very apt, to hold

old ones in contempt. In attempting to accomplish some end for notoriety, we are too much given to the habit of neglecting what many might denominate trifles.

"It is a recent thing to attempt to regulate the natural growth of the teeth, as if they were to be made an exception to every thing else. To remove a tooth has been considered as equivalent to the loss of a tooth, as if numbers were regarded in the light of compensation for irregularity.

"If the pulling rings which I have commended to the profession, do not invariably result in improvement, we have no right to infer that their use is to be condemned. Such a principle would lead us to discard all but literally sovereign remedies, known only to the credulous and the quack.

"Having two difficult cases some six years since, I was led particularly to study the best means to be employed in managing them. The spiral springs were too stiff, or too yielding and the gold bands were difficult to adjust. I looked for a substance that would accommodate itself, if I may so express myself, to the circumstances of the case, a substance that would exert a steady power, and adapt itself to the variations of a changing growth in the teeth, which were the subjects of treatment. I could think of nothing more proper than India rubber, and with a view to obtain rings of various extent, I ordered tubes to be made of the different sizes which, by cutting transversely, I had at once a class of instruments the simplest of the simple, and the cheapest of the cheap. They were easy of application and with improvements such as I have been able to make, they proved to be efficient for all ordinary cases of irregularity.

"In favoring the use of India rubber tubes, or rings, I would not be understood as underrating all other contrivances, or any of them. I speak an honest opinion, founded on my own experience. Let it be received for what it is worth. I ask no commendation that contributes to personal consideration, or to motives which are not common to the profession. Though simple, these rings cannot be used with advantage, unless applied with the utmost care, indeed, a careless application of them may create new difficulties, or aggravate old ones.

"The exact position of the teeth, the line of force to be observed, and the tensity of the power to be exerted, are all considerations requiring study, and a careful judgment. I submit the means for your consideration and trial, well knowing that you are too practical in your views to decide upon their usefulness without a knowledge which alone can come from experience and observation, and that you will not be inclined hastily to condemn any method of practice which promises a common good, without a patient and unprejudiced examination. It might seem to a superficial person as favoring too much the profession, if we were to recommend to the parent and physician, an early resort to the dentist for advice and service, in reference to the teeth of children; and yet, such a course would result in economy and comfort.

"I would advise a wide survey for discovery, that no one may be neglected who has genius and skill, and a disposition of inquiry. Such a line of conduct, may lead not only to the improvement of others, but result in profit to ourselves. I am no friend to professional jealousy, to that stinted view of things which commences with suspicion, and ends with contempt. It is unworthy of a man, when considered in his moral relations, as being responsible of his motives and

his acts. We sometimes avoid men, because of preconceived opinions which are unfavorable to their standing, or capacity, when perhaps a more disinterested mood of intercourse might often times bring within our sphere persons eminently fitted for professional distinction, and who require no aid but the right hand of fellowship to ensure a confidence and to command a skill. Genius is limited to no class—success is confined to no family. The brightest gem is sometimes thrown up by the humblest miner, and it is not for us to say who is to be or who is not to be, the leader in discovery, the greatest in our art, or the profoundest in his inquiries in advancing science and elevating the profession with which we are proud to be identified."

Fig. 11.—Thomas W. Evans. (1823-97.)

J. L. Levison, in *"Jaws and Teeth of Semi-barbarous Men,"* (1852) says:

"The jaws of civilized men are more contracted than those of semi-barbarous race and this is the result of the direct violation of the Creator's laws, who wills that the brain and nervous system of the growing child should not be overtaxed and that the dental process of attempting to build up the organic instrument and cultivate the mental faculties at the same time is a matter almost impossible to accomplish."

Thomas W. Evans (1823-1897) on his return to his native country from Paris read a paper *"On the Regulation of Teeth,"* in which he showed a number of new methods in Orthodontic treatment. One method in particular, although brought out by many in later years, as new, we employ in our present day procedure. He described a means of anchorage made by soldering a metal tube to the side of a band. Through the tube, he passed a hard drawn flat wire that was to be "lengthened or shortened with screw-nuts." Since that time tubes

soldered to the band with an adjustable arch have been in use. During the early numbers of the American dental periodicals, illustrations were rare, therefore many well known devices were merely described and not illustrated, and for that reason we presume "what is new is really old."

T. W. Evans of Paris, "On the Regulation of Teeth," pages 65-75, *"Dental News Letter"* (1854):

"I need not impress upon any person in this audience, gentlemen, that irregularity of the teeth is one of the most fruitful causes of their decay. To prevent this irregularity or where such precaution has been neglected to remedy it, is one of the most important branches of dental science. I have therefore made it a particular study. Circumstances have favored this course.

"I do not hesitate to say that nine-tenths of those who are in constant consultation with a dentist, would rarely, if ever, have had personal occasion for his services, if their teeth had been properly regulated in childhood. Irregular and defective teeth, now the almost universal rule would, if the proper precautions were taken, be the rare exception. Hence the pre-eminent importance of our profession; hence the family dentist is as necessary in every community as the family physician.

"But for a long time I was seriously inconvenienced in my operations for want of sufficiently complete apparatus. Much of that in general use, I found to be often inefficient, and generally very annoying, if not injurious to the patient. I have accordingly spent much time in constructing apparatus suited to my own practice; apparatus uniting all the conditions of promtness and efficiency, and giving the least possible inconvenience to the patient. Ligatures as generally employed, I found peculiarly open to objection; for besides their rarely operating with sufficient certainty or steadiness, they often loosened the teeth to which they were attached for support, and almost invariably tended to lay bare the gums.

"As for the other apparatus of bars, springs, caps, plates, inclined planes, etc., while there were portions of it not without merit, and some of it showing great ingenuity, it was, for the most part, so complicated or so cumbrous, that in the few cases where it accomplished the desired end, it did so only with an amount of fatigue and pain to the patient that he often found the remedy worse than the disease. These difficulties I have sought to avoid, and the success I have met with in most of my operations, some of them extremely difficult, has compensated me a thousand fold for my pains. The chief duty which remains to me is to communicate the result of my labors to you, my much esteemed colleagues, and through you to the profession at large.

"The principal desiderata in apparatus for the regulation of teeth are:

"1st. A firm support which shall not loosen or in any way injure the teeth, to which it is attached. 2nd. A steady and sufficient pressure, which can be graduated to suit particular cases, and particular stages of an operation. 3rd. Great delicacy of construction that the apparatus may be as light as possible, so as neither to injure nor annoy the patient. 4th. Finally, a mechanism as simple as the case will admit of in order to economize both labor and time.

"The first case which I would call to your attention, as illustrating the advantage of the apparatus, is that of,—

"Restoring an oblique upper incisor to its place.—The first thing, of course, is to make room for the operation, if as is generally the case, room is required. This is accomplished by bits of India rubber one-sixteenth of an inch in thickness, which are inserted between the irregular tooth and its neighbor on each side, and is prevented from sliding up to the gum by means of waxed floss silk wound tightly round the middle of the tooth. The necessary space obtained, I take a piece of fine hard wire, about the size of a common pin, and winding one end of it twice round the middle of the oblique tooth, very closely, I pass the other end along to the bicuspids or molars, to which I attach it by means of a joint—mechanism of two nicely adjusted bands or rings—forming a kind of yoke which

Fig. 12.—Method of rotating incisors.

Fig. 13.—Clamps or bands as used by Thomas W. Evans.

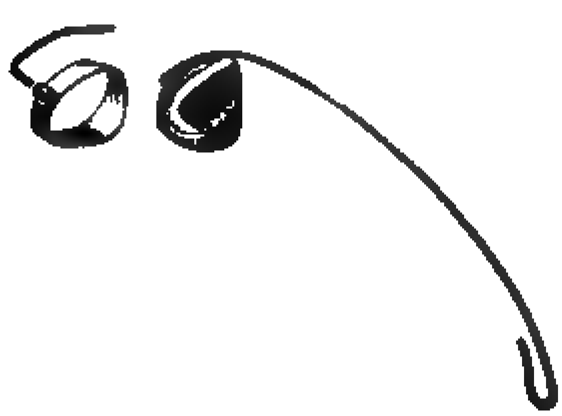


Fig. 14.—Band with gold tube soldered to same.

Fig. 15.—Retainer.

is slipped over two of the bicuspids or molars, and is prevented from slipping up to the gums, by means of wire clamps which hook on to their grinding surfaces. (Fig. 12.) These clamps may be so constructed, when an operation requires it, as to prevent the teeth of the upper and lower jaw from coming in contact with, or overlapping each other. (Fig. 13.)

"It will be seen at once, that if this apparatus is rightly applied, the hard-drawn wire being elastic, and serving at once as lever and spring, will bring the oblique tooth round to its place in a short time. But in all cases where, from the age of the patient, or for any other cause, the tooth is too refractory to submit to so gentle a lever, I modify the apparatus as follows:

"First.—Carefully adjusting a gold band (made of 22 carat gold, so as to

be sufficiently malleable) round the center of the tooth to be operated upon. On the front of this band, and directly across it, I solder a small gold tube, the bore of which is about the size of a common pin, through this tube, I pass a hard-drawn wire fitting very closely and then attach the outer end of it (which has a loop or eye for the purpose) to the yoke or skeleton cap above described, which is previously fitted to two of the molar or bicuspid teeth. (Fig. 14.) In this way it will be seen we have a more powerful lever than before, and one which is equal to any emergency. This operation being completed the tooth is kept in its place, by means of a small flattened wire, (somewhat smaller than a knitting needle,) which I pass in front of the incisors as far as the eye teeth on each side, to which it is attached by means of a small frame work with two hooks, which I solder to it, and which taking hold of the cutting edge of the central incisors afford a firm and steady support. (Fig. 15.) It is obvious that the wire band thus arranged and sustained will easily keep the restored tooth in its place. The length of time it must be worn depends upon circumstances. It should be removed as often as possible, for the purpose of cleansing.

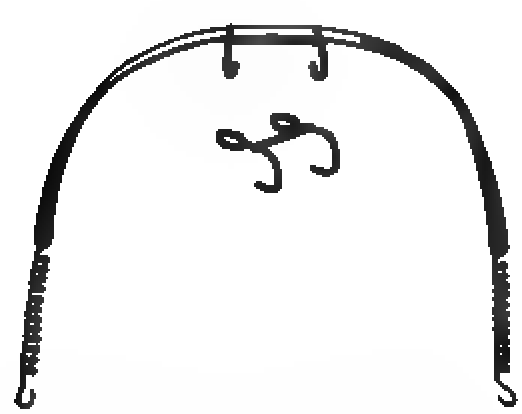


Fig. 16.—Method devised by Thomas W. Evans to correct protrusion of the anterior teeth.

Fig. 17.—Fig. 16 applied to the teeth.

"Protrusion of the front teeth.—I remedy this irregularity by means of a narrow elastic bar of gold, which is attached to the front of the teeth to be operated upon, by means of a kind of wire grating, constructed with hooks which take hold of the cutting edge of the central incisors, and keeps it, the bar in its place. (Fig. 16.) Having slipped this bar into the grating firmly, I pass the ends along to the strongest molars on each side, to which it is attached, by means of short spiral springs, the molars used for support having previously fitted to them the yoke or skeleton cap already described. Now to give this elastic bar with its spiral springs an absolutely firm and steady support, which should have its pressure equally distributed over the mouth instead of being confined to one or two teeth, I prepare a thin gold plate of the most delicate workmanship, which is moulded carefully to the roof of the mouth, and kept in its place by attaching to the molar teeth by the apparatus which already secures the gold bar. This plate, if nicely moulded to the irregularities of the mouth, has its pressure, as I have said, equally disturbed, and renders it impossible that the teeth used for support should be loosened, since they are sustained by the

whole palatin arch against which the plate presses. The elastic bar with its spiral springs, has thus the firmest and steadiest hold possible and can only move the teeth which it is intended to move, and these it brings easily and quickly to their place. (Fig. 17.) The patient easily gets accustomed to the apparatus because of its great delicacy of construction and finish. I should add that, as the teeth come gradually back to their place, they will naturally force the gum inward. The plate must therefore be moved several times during the operation and be modified, both in size and form; care being taken always to have it nicely adjusted and to keep it at least one-third of an inch from the backs of the teeth to be operated upon.

"The advantages of this apparatus over the use of ligatures as commonly applied have already been hinted at in the course of the description. They may be summed up as follows:—(1) By avoiding the risk to which ligatures are usually liable of injuring the teeth by slipping down to the gums. (2) By having an absolutely firm and steady support, equally distributed over the mouth, I avoid loosening the teeth used for support, and then give the patient the least possible annoyance. (3) By means of the gold plate fitted to the roof of the mouth, I accomplish the important desideratum of acquiring a sufficiently strong support for any power I may wish to exert upon the teeth to be operated upon, without (as I have said) running the risk of displacing any others. (4) In fact, the power obtained by means of my elastic lever and spiral spring with their firm steady support, is much greater than the traction of any apparatus of ligatures or any apparatus whatever not thus supported, and is, therefore, easier, more prompt, and surer in its operation. To keep the front teeth in their place after they have been restored, I first remove the plate which has been modeled to the roof of the mouth, and then re-adjust it upon a new cast, attaching it by the same means as before to the molar teeth; then take a piece of hard elastic gold wire, flattened to about one-sixteenth of an inch in width, and pass it along in front of the teeth which have been operated upon, attaching the ends of the rings which have been previously re-adjusted to the molar teeth on each side. This elastic band, pressing gently against the teeth, easily accomplishes the purpose.

"The next step is to adjust the yoke or skeleton cap already described, to the strongest molars on each side of the mouth. Next, molding the gold plate to the roof of the mouth, in the manner mentioned in the last case, commencing pretty well back, and coming forward to within about one-fourth of an inch of the deviating teeth; this plate is attached to the molar teeth by mechanism just alluded to—the whole forming in fact, but one apparatus each part of which is necessary to the other, and to the whole. Having thus secured the strongest and steadiest support, I solder one end of a gold wire (about the size of a knitting needle) to the face of the innermost ring attached to the molar teeth, and as near as possible to the back edge. The other end of this wire (the whole being hardened and flattened from the soldering point), I pass along on the outside and parallel to the margin of the gum, at about one-sixteenth of an inch distance from the teeth, and slide it into a small tube, which I had previously soldered for the purpose, to the back edge of the skeleton cap, adjusted to the molars on the opposite side of the mouth. This bar is kept from slipping too far through

the tube by being tapered at the end, which causes it to enter like a wedge; on the other hand, it is kept from receding from the tube by means of a small nut, or being flattened at the end. (Fig. 18.) The average width of the bar is about one-sixteenth of an inch. I curve this bar along the margin of the gum, as already described, and then attach each of the deviating teeth to it, by means of circular India rubber bands cut from a pipe or tube; these bands are first slipped over the tooth, then stretched under the bar, to be brought up on the other hand side and re-attached to the tooth, by which means they have a firm, double hold and traction. Nothing need be added to show that these strong, elastic bands thus supported, accomplish the work of bringing forward the teeth in a manner at once simple and easy. In this case as in the last, I retain the restored teeth in their place, by re-adjusting the gold plate, having first however, added to it a kind of supplement extending to the inner face, and carefully adapted to their posterior and irregular surface. This plate secured as before, and with the supplemental plate resting against the restored teeth, checks their tendency to grow inwards and thus maintains them in their proper position.

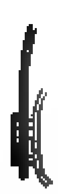


Fig. 18.—The beginning of the modern orthodontic arch, threaded with nut attached. Used in conjunction with a tube soldered to a band.

Fig. 19.—Gold plate.

"The next case is where the same front teeth, instead of all being within the dental ridge, have grown irregularly—some within and others without, or what is called zig-zag. In this case I naturally use about the same apparatus as before, with this difference; that the flattened wire or bar, is made smaller and more elastic, and can be lengthened or shortened by means of screw-nuts. The teeth which grow inwards are brought outwards by means of India rubber ligatures attached to the band. I preserve these teeth in their places by striking up a fine, thin gold plate over the backs of the six front teeth, extending down from one-fourth to three-eighths of an inch, and running over the cutting edges about one-sixteenth of an inch. This plate, made of soft ductile gold, should be carefully adapted into the inequality of the teeth and maybe generally kept in its place by the mere effect of suction, or on the principle of atmospheric pressure but where atmospheric pressure is not sufficient, with the ordinary shape of the plate I modify it (the plate) by making a small air chamber in it, which I have generally found to answer the purpose. Another way of keeping the plate in its place is, to let it extend back as far as the first bicuspid, and solder a tube to it on each side, with the mouth opening against these teeth; into these tubes is inserted a piece of hickory wood which swells enough to afford a sufficient support. (Fig. 19.)

"The skeleton cap or yoke is fitted to the two strongest molars; one end of a gold wire, about the size of a knitting needle, is then soldered to the back part of the yoke, and carried to the other end, forward to the deviating tooth, to which I attach it by means of a silk or India rubber ligature. The elasticity of the wire, which, of course, is hammered hard from the soldering point, is sufficient to bring the tooth back to its place in a short time. The apparatus for keeping this tooth in its place, is also applicable to several cases, as the intelligent hearer will perceive. It consists simply of a thin gold plate, curved over so as to take hold of the front teeth by their cutting edge, and keep them in their place by this hold, and by suction.

"I have thus far spoken chiefly of the irregularity of the upper incisors, but one of the commonest cases I have to treat is that of,—

Protrusion of the eye-teeth.—My mode of treatment, is, substantially as follows:—if the teeth are so crowded that there is hardly sufficient room for the canine to come down to its place, I bring the incisors forward in the manner already described, and in this way easily obtain the necessary space by the expansion of the dental arch. But if the space wanting is too great to be obtained in this way—in other words, if the bicuspids and incisors touch, or nearly touch —I extract one of the former and then, if the tooth is so high up that in waiting

Fig. 20.—Method to correct protrusion of the canine teeth.

for it to come down we are likely to lose the space thus obtained, I construct an apparatus for hastening the descent of the tooth and guiding it to its place. This is applied as follows:

"I adjust the yoke or skeleton cap, already described, to the molar teeth, which I prevent from being loosened or displaced by means of the gold plate moulded to the roof of the mouth. I then solder one end of a gold wire to the back of the skeleton cap, and having hammered the rest from the soldering point, so as to make it elastic, I curve it inwards towards the eye tooth, against which the other end of the wire presses gently, operating as a spring, and aiding and directing the tooth to its place. (Fig. 20.) If the protrusion be such as to require it, the wire may be crooked where it touches the eye-tooth, so as to bring it both inward and downward.

"I have thus, gentlemen, given you, as clearly as it is possible for me to do in a public lecture, some of the results of my labors in the way of regulating teeth. If I have failed to make myself perfectly clear, I shall be happy to make any explanation which may be required of me. For, in my view, gentlemen, ours is a science far too noble in its character, and involving far too many gen-

eral interests, to be hampered with any monopolies. A patent for a particular mode of regulating teeth, seems to be as absurd as a patent for a particular mode of setting a bone or curing a fever. There is something almost sacrilegious in the very idea. Everything we discover for the benefit of human kind, should be known and read of by all men. It should be published in the streets, and

Fig. 21 —Asa Hill. He gave to dentistry Hill's stopping.

proclaimed from the house-tops, that thus we may humbly imitate that generous Providence, which sends its rain alike upon the just and unjust, and scatters its light broad-cast over the whole face of the earth."

The original article was not illustrated, those used are from a review of the above article by *W. Storer How* and published in the *Dental Cosmos,* 1891.

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

JAMES DAVID MCCOY, D.D.S., EDITOR
LOS ANGELES, CALIF.

DENTAL FOCI OF INFECTION, THEIR CAUSE AND PREVENTION*

BY E. A. SCHRADER, D.D.S., INDEPENDENCE, IOWA.

I BELIEVE that medicine in the future will consist largely in a search for foci of infection, and their removal, that instead of treating symptoms, as rheumatism, heart trouble, etc., it will be a search for the particular focus of infection causing that malady.

The following list of diseases is an exact copy taken from the *Journal of the Research Committee of the National Dental Association*. This Association is composed of the leading members of the medical and dental professions.

"Systemic Diseases Resulting from Oral Infections."
Arthritis Deformans.
Iritis and other Eye Troubles.
Focal and Diffuse Kidney Infection. (Nephritis or Bright's Disease.)
Blood Vessel Coat Disease.
Heart Infections, as Endocarditis and Myocarditis.
Stomach and Duodenal Ulcer, Appendicitis.
Liver Infections, including Cholecystitis and Gall-Stones.
Skin Diseases, including Erythema Nodosum and Boils.
Nervous System Infections, including Neuritis, Neuralgias, Tic-Douloureux, Sciatica and Herpes Zoster.
Glandular Infections including Thyroid, Pancreas and Lymphatics, etc.
Pneumonia and Lung Infections.

It is not claimed that foci of infection in the mouth are the most frequent or the most important. The mouth up to the past few years, and with many of the medical profession, still is completely ignored, but to make a thorough diagnosis for the cause of systemic disease, it should have a complete examination. We should do team work. The dentist and physician must work together.

When a systemic disease exists, due to focal infection, and the cause is not known, the teeth should be examined first, as there are more teeth than other parts to produce infection, and infection is more easily removed from the mouth.

It was thought that all teeth were healthy which were comfortable and performing the functions of mastication but the x-ray shows many such teeth diseased.

*Read before the Delaware County Medical Society, Manchester, August 8, 1916. Published by special permission of Iowa State Medical Society.

In some cases, there are rarefied areas over the apices of the roots, places where part of the bone has been absorbed. We do not know what germs these areas contain without a culture being taken.

The germs found in diseased areas about the teeth are according to Gilmer and Moody, mostly streptococcus, both viridens and hemolyticus, bacillus fusiformis, together with other organisms such as staphylococcus aureus, or albus, micrococcus catarrhalis, and in two instances, diphtheroid bacilli have been found. The streptococcus viridens seems to be the germ most commonly found.

Some of these rarefied areas exist, according to the Chicago Research Committee, where the tooth once had an abscess to cause this absorption, and was later treated and the root filled. Instead of filling in with bone tissue, it filled in with connective tissue, and contained no pathological germs. If a patient has some systemic disturbance caused by a focus of infection, and no other source has been found, these areas should either be curetted with the amputation of the end of the root, or the tooth extracted with curettement.

Dr. E. C. Rosenow has for some years been conducting a series of experiments which can leave no room for doubt, as to the culpability of the teeth and tonsils in the production of such systemic diseases as articular and muscular rheumatism, endocarditis, streptococcæmia, and other allied conditions.

Starting with a certain form of streptococci, Rosenow was able, by varying the culture conditions under which he grew the organisms, to transform the original type into other types of streptococci which we have been accustomed to look upon as distinctly different from one another in their biological, serologic, and chemical characters. Not only was he able to produce different forms of streptococci, but he further changed streptococci into diplococci of pneumonia and vice versa.

The essential cultural factor which he used in bringing about these changes was a variation in the degree of oxygen tension. He showed that rheumatism, etc., were embolic in origin; that is, that a clump of organisms became lodged in a capillary loop which was too small to admit of its passage, and would locate in a given tissue for which the given organism had a particular affinity. If this was in a heart valve, an endocarditis resulted, if in the tendinous end of a muscle, a muscular rheumatism, if in the synovial membrane of a joint, an articular rheumatism. Teeth affected with pyorrhea, inflammation around ill fitting crowns and bridges, and impacted teeth are foci of infection found in the mouth.

DEAD TEETH.

The largest number of foci of infection in the mouth are caused by dead teeth. They may die from several causes, such as decay, a severe blow, hypercementosis, pyorrhea, and the dentist. If we could have the cooperation of the patient and dentist, there would need be but few places of infection from this cause. When the nerve dies from decay, it suppurates, forming a fine tube of pus to infect the tissues about the end of the root. It may cause an acute abscess, with severe pain and swelling, or a blind abscess with little or no pain, with no external evidence of trouble or may lie dormant for some time without any apparent trouble. Many times the aforesaid conditions are treated, but

enough of the infection remains to leave a blind abscess with no outward manifestations, and which causes systemic disturbances. A number of dentists are taking up the method of ionizing the nerve canals which are infected, to not only disinfect the canal but to drive the sterilizing agent into the deeper tissues. According to our x-ray findings, rarefied areas will fill in with new bone, after being ionized, if they are not too extensive. If extensive, they can only be cured by amputating the diseased end of the root and curetting the affected area, or extraction and curettement.

In case of extraction of teeth with blind abscesses, the tooth should not only be extracted but the diseased area curetted. These blind abscesses may cause the absorption of areas as large or larger than a pea, sometimes a half inch in diameter.

TEETH DEVITALIZED BY DENTISTS.

This, I believe, forms the great majority of cases of focal infection. On this account nerve operations are condemned by many physicians, but the operation is not to be condemned so much as the manner in which it is done.

The late Dr. Eissen found in 1000 cases examined where teeth had been devitalized, .3 per cent of perfect root canal fillings showed signs of disease. This may have been due to a lack of asepsis. He found 13 per cent of perfect root canal fillings out of the 1000 cases.

Dr. Elmer S. Best found out of 3000 cases of devitalized teeth, 10 per cent of perfect root canal fillings.

In my own practice, of 155 devitalized teeth examined, twenty-four had mechanically perfect root fillings, 117 had mechanically imperfect root fillings and fourteen had no root fillings. Of the perfect root fillings, one had a rarefied area over the root. Of the teeth with imperfect root fillings and no root fillings, 107 had rarefied areas.

When the nerve is entirely removed under aseptic precautions, and the root is sealed to the end, there is little danger of infection from that tooth.

When the nerve is not perfectly removed, a small end remains which later decomposes and suppurates. It then infects the tissues about the opening at the end of the root, causing either an acute or chronic abscess with or without a fistulous opening. It is generally a blind abscess without any external evidence of trouble, but forming a focus of infection for some systemic disease, or nature may take care of it without apparent trouble.

We know that Nature is doing a great deal to take care of these conditions, as nine out of every ten of the nerve operations are not perfect, and about 70 per cent of these improperly filled canals have rarefied areas over them. So there are but few mouths that do not either have some of these imperfect nerve operations, some impacted teeth or pyorrhea as a source of infection, and yet most of these people are healthy, but we do not know when these germs may become active and some systemic disease result.

You may ask, what right has the dentist to perform these nerve operations improperly, and who is responsible for these diseased conditions that have been caused by them?

We can only plead ignorance as our excuse and add that we consider ourselves excusable in the past because we did not know and did not have the methods of doing perfect root-canal operations. Until recently we considered all nerve operations successful if they prevented further toothache.

Quoting an extract from Dr. Howard Raper's lecture at the Panama Pacific Dental Congress: "In the first place I take it that we can agree that there

Fig. 1.—Blind abscess on lower bicuspid. Imperfect root filling. Patient subject to headache much of the time.

Fig. 2.—Same as Fig. 1. Six months after bicuspid has been ionized and filled with a perfect root-filling. Note the new bone about apex. Headache much diminished after treatment. Third molar has been removed.

is such a thing as poor root-canal operations. In fact most nerve operations are of this kind. I do not agree with the man who says, 'Our nerve operations are a disgrace.' Mirl Stro says, 'It is no disgrace to wear rags, the disgrace lies in continuing to wear them.' The extensive use of the radiograph and the theory of infection has set a new standard. Methods which fulfill the requirements of the old standard, fail to meet those of the new, and consequently must be discarded, and replaced by methods which prevent instead of aid the

development of foci of infection. This places the dentist in rather a difficult position." Dr. Henry Carr facetiously expresses it: "If he does his nerve operation as he has been doing it, he gives his patient heart trouble. If he takes the time necessary and does it as he now believes it should be done, he gives his patient heart failure when he presents his bill."

If we do this work properly it will make the fee seem exorbitant and pro-

Fig. 3.—Bicuspid with imperfect root-filling, draining directly into antrum.

Fig. 4.—Root between the first molar and second bicuspid. Extraction sixteen years previous. Was the cause of neuralgia.

hibitive; but if it is the only way to prevent these teeth at some time causing, in a certain per cent of cases, rheumatism, etc., we must adopt the latter method or the patient run his own risk, that by saving a few dollars and not have it done properly he might contract one of the many diseases which result from focal infections.

There are men who are placing no root filling in their nerve canals nor

removing all of the contents, but relying on some paste to preserve that dead nerve. These teeth are a very frequent source of trouble and on making a culture from these supposedly mummified nerves, at a later time they are found to contain pathogenic germs.

I know of a case of an actress who left the road on account of severe headache. The x-ray showed three such filled teeth. On opening and draining these teeth, the headache ceased. In the light of our present knowledge I be-

Fig. 5.—Large cyst above molar. Tooth devitalized but no root-filling.

Fig. 6.—Pyorrhea pocket with instrument showing depth below level of gum.

lieve that such root canal work is criminal. Suppose some of these teeth would cause a painful case of rheumatism and heart trouble and on finding them devitalized with unfilled roots which the x-ray shows badly diseased, these are removed and the patient gets well. Is this not cause for criticism? Quoting what some other men have to say on this same subject:

Dr. M. I. Shamberg, Oral Surgeon of the Post-Graduate Hospital and School of Medicine, N. Y. "The sad reality faces us today that our hospitals

are filled with patients who are bedridden, some crippled for life and aye! many of them dying, as a result of focal infections about the teeth and jaws.

"There is no longer any question as to the large variety of systemic dis-

Fig. 7.—Perfect root-filling in left central incisor. Other central had been devitalized twenty years. No apparent trouble but patient had goiter. Note large cyst.

Fig. 8.—Same as Fig. 7 immediately after root has been perfectly filled and amputated and cyst curetted.

eases that are due to oral infection, and herein lies the great problem before us today. In the cases of polyarthritis where structural changes have taken place within the joints, and atrophy of the limbs have resulted from prolonged

non-use, only slight improvement will take place because the injury is too great to permit of repair. It is therefore incumbent upon you to exercise prophylactic measures and thus prevent these serious diseases of mankind.

"I have noticed hundreds of cases in our wards, that patients who seek charity at our hands give evidence of having spent considerable money on a type of work that is common to our dental parlors, and of unscrupulous dentists who are putting gold crowns and bridges in the mouths without regard to the damage that work produces. It should be considered a crime to put a gold crown or bridge on a tooth unless that tooth is properly prepared to receive it.

"We need a few Billy Sundays to go through the country before the members of the dental profession, to teach not only the doctrine of prophylaxis, but extraction of teeth where they are likely to be a menace to the health of the patient."

Dr. H. S. Vaughan, New York: "Roots filled by careful men and supposedly all right in the light thrown by the x-ray have been shown to be a source of infection. These infections may be from the small blind abscess or the larger bone abscess or have undergone cystic degeneration and perhaps involved a large number of teeth, then we have them breaking into the antral sinus, or the nasal cavity. These cases often require extensive surgery in order to effect a cure; and all this due to imperfect canal work.

"Radiography is not a luxury, it is an absolute necessity in the light of what is being proven. The work in the past has been the treatment of existing diseased areas, that of the future prevention."

Many times when you look into the mouth, you ask your patient how his teeth are. He says "perfectly comfortable" as he has just had them fixed and they should not trouble him, for most of the nerves are removed. You may exclude the mouth after hearing this in your diagnosis but as soon as he mentions devitalized teeth you may be on the right track. You may send him back to his dentist for an examination but no such examination can be complete without the use of the x-ray, and the dentist must be conscientious enough to condemn his own work if it is found to be at fault.

In my own practice, three years ago, a case presented with the teeth badly worn off. These were restored to the original shape with gold inlays. From the excessive wear some of the nerves may have been diseased before the teeth were filled or they may have later died from the irritation of the fillings being too close to the nerve. Last winter he developed an attack of rheumatism and was confined to bed. One antrum was affected which was opened through the nasal cavity. His physician questioned him about his teeth but he said they were fine, never gave him any trouble since they were fixed. He was confined to bed three weeks after which the one knee remained stiff and he was able to get around with crutches for about two months. Being my patient, I persuaded him to have his teeth x-rayed. Large areas of absorption were seen in region of both antra and on extracting these teeth, found these areas to extend into the antra. A few weeks after the last ones were removed, he was able to discard his crutches and go to work. In his case two teeth

were extracted and curetted at each operation. Each time, for a few days following, his condition was worse, due to the germs getting into the circulation after breaking up the abscess walls.

It is a mistake to take out too many teeth at one time when a patient is suffering from infection. Cases are on record where this has been fatal.

Some years ago I removed a nerve from a tooth of my wife's. For several years she had been having headache in the back of her head, having it a good share of the time. She consulted eye specialists, and general practitioners without relief, always kept a supply of aspirin and phenacetine on hand. Was fitted with glasses but this did no good. In February a radiograph of this tooth was taken and it showed an area about the size of a pea that was absorbed.

Fig. 9.—Large cyst caused by devitalized tooth without root-filling.

After opening and ionizing the tooth it has almost cleared the headache. She also had considerable pain in the region of the heart previous to treatment but which has now disappeared.

CROWN AND BRIDGE WORK.

The subject is claiming considerable attention at the present time. Leslie's Weekly has had some very good articles on this subject. Dr. Hunter of London started the criticisms when he condemned American dentistry, and we became quite indignant, but we must admit in the light of our present knowledge, that he was right to a great extent and a number have changed their methods, but far too many have not.

Most of the abutments for crown and bridge work are devitalized teeth. We know that nine out of ten devitalized teeth are not perfectly done. That makes nine out of ten subject to infection, then place an additional burden on these already weakened teeth, we have the reason that so many bridge teeth are a source of infection. The same thing holds true concerning crowns as

root-canal operations. It is the exception to see a properly fitting crown. To make a properly fitting and sanitary crown requires considerable time. The nerve operation is generally thrown in without extra charge.

The dentist with an average degree of skill would consume on an average of three hours for a perfect root canal operation on a molar and two hours on the crown. Then if it cost him $1.50 (about the average cost for each producing hour) he would make a profit of 50 cents net for five hours work. So you can see why crowns are not sanitary. I shall pass a few samples around that you may note the fit at the gum margin and you can see the favorable place for filth.

A crown can be made sanitary, but it requires considerable more time than is ordinarily given the operation.

Fig. 10.—Small blind abscess at apex of crowned bicuspid with imperfect root filling. The removal of this tooth with six others in the same month cleared the case of rheumatism, heart trouble and neuralgia.

IMPACTED TEETH.

The next source of infection are impacted teeth. Some may have part of the crown visible, the presence of others can only be determined by the use of the x-ray. They may cause neuralgia, insanity, ear disorders, and eye disorders or any diseases caused by other foci of infection.

The late Dr. Henry S. Upson of Cleveland, Ohio, has cured cases of melancholia, mania, and dementia precox, by locating and removing impacted teeth.

Since certain forms of insanity might be cured by locating abnormal oral conditions, it would seem that there should be a competent dentist in each hospital. He should also be an expert roentgenologist.

Dr. Craig, M. D. of the neurological hospital of New York says: "The continued swallowing of pus is undoubtedly the cause of disorders of digestion, and finally an anemic state almost cachectic. This depleted exhaustive state may be associated with a melancholic state. It seems a far cry from mouth infection to mental disease, but where one witnesses profound depression clear up following the drainage of several pus pockets, one is persuaded that the

chronic intoxication, the result of absorption from the pent up infectious process, was an etiological factor."

Dr. E. A. Rogers of Iowa University and myself made an examination of patients in the insane hospital just as they happened to be brought to us.

Fig. 11.—Large cyst remaining after a tooth had been treated for a fistulous opening and not cured. Showing perfect root-filling.

Out of forty lady patients, one had teeth which could be pronounced healthy. The other thirty-nine had one or more defective teeth, some mouths fairly reeking in pus and so offensive that we had to hold our breaths to look into them. Might not some of these people be retained there on account of their teeth? Up to this summer, our insane hospital has had no dentist on the

staff, but they now have one and I believe he will do much to better the condition of the patients.

Dr. Upson cites a case of hypomania where a lady had screaming spells, was nervous and sleepless, but whose condition was cleared up by removing an impacted tooth and an abscessed tooth.

A physician twenty-eight years old became maniacal, talked foolishly but insisted nothing was the matter. Was cured by removing an impacted cuspid. He also cites a case of St. Vitus dance cleared up by removing impacted teeth.

Quoting from his book on insomnia and nerve strain: Of the viscera responsible for the more obscure cases of nervous and mental derangement, I have no hesitation in designating the teeth as the most important." There seems to exist among physicians not only a disregard, but a distinct, though mild dislike of the teeth as organs to be reckoned with medically. Ordinary pain at a distance, as headache or neuralgia, due to the teeth, though well known, is commonly disregarded." According to Dr. Upson's table including two and one-half years' observation out of forty-two cases operated on for dental disorders, where the patients were insane and dental foci were suspected, fourteen made a recovery and twelve improved. The different maladies were manic depressive type, dementia precox, psychosis, insomnia, neurasthenia."

PYORRHEA.

Pyorrhea is another source of infection and if recognized early, usually is curable, but if progressed to the stage that the teeth are loose, little can be done for it, as the bony wall surrounding the teeth is gone and not a sufficient amount of new bone will regenerate to hold the teeth firmly in their sockets.

The treatment of the early stages of pyorrhea is not difficult and the disease is easily cured unless complicated with some systemic disease, as syphilis, etc., but as we ordinarily see it, it is easily cured. Dentists do not seem to pay much attention to it until the teeth start to loosen, and then they have little success with it. In the later stages it requires a high degree of skill to remove all deposits and unless this is done, there is no hope for a cessation of the disease. Many beautiful sets of teeth are lost, which if taken in time would have been as easy to save as the ordinary teeth are saved by filling. The one great trouble is that the dental student expects to get all of these methods of treatment at college, and he should. He is taught the treatment of pyorrhea, it is true, but the treatment is not sufficiently thorough, neither do they have instruments properly shaped to reach all of the surfaces of the roots and this is essential for a cure. A set of instruments has been invented with which all surfaces of the teeth can be reached but they can only be obtained by taking a special course, and I believe every dentist should have this course. Some men get enthusiastic over the use of some remedy in the treatment of pyorrhea, claiming great results for the medicine but state incidentally that all deposits be removed and the surfaces of the teeth made smooth, that after making six injections all signs of pus disappear. By removing all deposits and making the surface of the tooth smooth, the flow of pus will cease with one treatment unless complicated with some systemic disease. I do not believe many realize

what a filthy disease pyorrhea is. In a bad case, it would not be unusual to have a pocket under the gum of each tooth a quarter of an inch in depth. Suppose they have twenty-eight teeth. Then we have a pocket the total length of which is seven inches. This is filled with pus and in addition food is pressed into it to decompose. Then after a time, some of these nerves may die, due to the movement of the teeth or to the pus infecting them, and we also have some blind abscesses develop. If we get a drop of pus from each pocket every twenty-four hours, which I think we will, that would be approximately one-half drachm of pus to be swallowed and that from the blind abscess to be discharged into the blood stream. Nature is very kind to tolerate this condition, but she often rebels. As in root-canal operations, there are not enough dentists doing this work that it may be of any help to you in focal infections.

Fig. 12.—Blind abscess on mesial root of second molar and distal root of first molar causing systemic disturbance.

When the time comes when dentists will specialize and do their operations in the most thorough manner, then they will be of considerable help to the medical profession in eliminating disease.

Since we are finding that the teeth are often found to be the source of infection, there are among the professions, men who will go to the extreme and advise the extraction of many healthy teeth. This is being done at the present time, but after a careful examination including x-ray, the teeth are found to be healthy, we have no right to advise extraction.

At this time it may not be out of place to cite a number of cases.

Dr. R. T. Woodyatt has called attention to the frequency with which exophthalmic goitre is associated with infected mouths. He has also collected a number of cases of glycosuria in which infections of the mouth were present and the glycosuria disappeared after the infected teeth or tonsils were removed.

As an example I will cite the following case from my practice. Condition of patient reported by Dr. F. F. Agnew.

Patient, age twenty-four years, first seen December, 1915; patient had had trouble for six months; loss of weight, nervousness, insomnia, body tremors and weakness. Examination—Thyroid gland moderately enlarged and firm. Tremor of fine character and general.

Pulse rate 120-140. Exopthalmus pronounced, von Graefe and Stellwag signs positive. Examination of the mouth revealed four blind abscesses and one impacted third molar. Improvement was early noticed after mouth condition was cared for, and now the patient is in every respect normal, even to size of thyroid without medical or surgical treatment.

Dr. Martin Fischer, professor of physiology in the University of Cincinnati, relates a number of cases among which is a surgeon who had suffered three years with rheumatism of the right arm. He had six lower teeth affected with pyorrhea. After having these six extracted, in two weeks the rheumatism had left.

If you will permit I shall cite more cases from my practice, for they will show the benefits to be derived by removing foci of infection about the teeth. These cases did not receive medical treatment.

Case of a lady who had her trunk packed to go to Colfax for rheumatism of shoulder Came in to have an abscessed tooth removed before she left. The rheumatism began to leave and in ten days was gone without going to Colfax.

Case of swelling of knees existing for ten years. Was sent to me to see condition of teeth badly affected with pyorrhea. At this time she was suffering from severe tonsillitis which her physician thought might be caused from the bad condition of teeth. She also had some heart trouble. Extracted worst pyorrhea teeth and treated balance. Tonsillitis, swelling of knees, and heart trouble left. It has been two years since this was done and there has been no recurrence of her former symptoms.

Case of headache of several years' standing cleared up by locating a partially dead nerve. Case sent with following description: High blood pressure, 200 M. M. systolic. Markedly accentuated second aortic, intestinal disorders of a low grade toxic sort. Also complains of so-called rheumatic pains. An examination revealed rarefied areas over seven teeth, one penetrating the antrum. These were extracted and curetted in March, 1916. A letter written by the patient August 1, 1916, states that she has been relieved of rheumatism, severe heart trouble and almost constant neuralgia in head and neck. Also stomach trouble is much relieved.

Case of physician who had an infected antrum. A Denker operation was decided upon. A diseased molar was located under the affected antrum, after the removal of which the antrum cleared up.

In all cases of antrum infection it should be determined if diseased teeth are causing the infection. One case had had two antrum operations without benefit, but which was later benefited by removing a diseased tooth. Of nineteen cases of rheumatism of which I have a record, where the foci of infection were removed from the mouth, eighteen were improved; one reports no improvement.

Stomach trouble, of two cases, both were improved.
Arthritis, of five cases, three report improvement, and two no improvement.
Heart trouble, three cases, all three improved.
Goiter, one case improved.
Iritis, one case improved.
Ear trouble, one case improved.
Headache, three cases improved.
Antrum, three cases improved.
Most of these cases report marked improvement.

Up to the present time, we have not been diagnosing all pathological conditions in the mouth, but have concerned ourselves too much with the repair of teeth.

AN UNUSUAL CASE HISTORY

By H. B. Hamilton, D.D.S., Ithaca, N. Y.

NOT long ago, a dental friend, in a spirit of raillery compared the orthodontist to a certain widely advertised remedy, saying that all the orthodontists had to do was to put on the appliances and let them work while you sleep. Unfortunately there is occasionally a case where the orthodontist puts on the appliance and then loses sleep trying to make them work.

The following brief report of a case illustrates this point. The patient, a boy of about nine, presented a comparatively simple case of distoclusion, the short cusps of the molars being the only unfavorable feature. The boy was of German-American parentage, very large for his age, and decidedly husky. His tonsils and adenoids had been removed and the healing was normal. He presented a perfect type of the healthy vigorous boy, but rather clumsy and blundering, and a terror to the parents of other boys.

As a patient in the chair he was ideal—nothing seemed to cause him even the slightest annoyance, but it was almost an impossibility to keep an appliance on and in repair. He was too husky,—every time he came in something was lost or broken, and he always had a good reason for it.

The prognosis was favorable, so while it is not completed, yet a very good correction has been obtained despite the difficulties. The following extracts from the case record show what happened:

Oct. 30th.—Cemented molar bands.

Nov. 3rd.—Fitted in 17 gauge platinum gold arches.

Nov. 10th.—Left superior band loosened, recemented.

Nov. 17.—Upper arch gone. In showing to a boy friend, the boy grabbed it and pulled it out and threw it away. New arch.

Dec. 8th.—Right intermaxillary hook broken off and left badly bent in trying to eat a frozen apple.

Dec. 22nd.—Upper arch close to buccal tube. Caught his fork in it.

Dec. 29th.—Upper arch broken at both buccal tubes. Some reason.

Jan. 5th.—Right superior molar band off and arch broken.

Jan. 12th.—Arch broken.

Jan. 19th.—Right superior band broken. New band.

Jan. 26th.—Left superior molar band broken. Upper arch broken. New band adjusted.

Feb. 9th.—Left inferior molar band broken. Upper arch broken. New band and new arch.

Feb. 22nd.—Upper arch broken at both buccal tubes. Lower arch broken in the middle and right superior molar band broken. New band.

March 1st.—Upper arch broken at both buccal tubes. New arch of 15 gauge nickel silver, with loops at buccal tubes.

March 8th.—Lower arch broken and left hook broken on upper.

March 15th.—Left hook broken on upper.

March 22nd.—Lower arch broken. New arch 16 gauge nickel silver similar to upper.

March 29th.—Left superior band broken.

April 12th.—Right inferior band gone.

April 19.—Lower arch lost.

April 19.—Lower arch lost.

May 10th.—Upper arch broken. New arch.

May 31st.—Left inferior molar band gone. Did not replace as mesiodistal had been corrected and the lower jaw was otherwise normal.

June 7th.—Left superior molar band gone. New band.

July 5th.—Upper arch lost. New one 17 gauge.

July 12th.—Upper arch lost. New one 15 gauge.

These few mishaps, together with the impossibility of keeping a ligature on and the arches being bent out of shape almost every time he came in, were the only difficulties encountered.

No retention other than the upper arch to maintain the width has been attempted, as I know of no way of making an appliance strong enough to resist the vigor of his masticatory efforts.

The International Journal of Orthodontia

PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 801-807 Metropolitan Bldg., St. Louis, Mo.

Foreign Depots—*Great Britain*—Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

Subscription Rates—Single Copies, 30 cents. To anywhere in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $3.00 per year in advance. Under foreign postage, $3.40. English price: 15/ per annum, 1/6 per number. Volume begins with January and ends with December of each year.

Remittances—Remittances for subscriptions should be made by check, draft, postoffice or express money order, or registered letter, payable to the publishers, The C. V. Mosby Company.

Contributions—The editor will be pleased to consider the publication of original communications of merit on orthodontic and allied subjects, which must be contributed solely to this journal.

Opinions—Neither the editor nor the publisher hold themselves responsible for the opinions of contributors, nor are they responsible for other than editorial statements.

Reprints—Since it is not desirable to hold type standing longer than absolutely necessary, all requests for reprints should be made at time of submitting manuscript for publication. Rate card will be sent with galley proof.

Communications—Contributed articles, illustrations, letters, books for review, and all other matter pertaining to the editorial department should be addressed to the Editor, Doctor Martin Dewey, 1016 East Armour Boulevard, Kansas City, Mo. All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 801-807 Metropolitan Building, St. Louis, Mo.

Illustrations—Such halftones and zinc etchings as in the judgment of the editor are necessary to illustrate articles will be furnished when photographs or drawings are supplied by the authors of said articles.

Advertisements—Objectionable advertisements will not be accepted for publication in this journal. Forms close first of month preceding date of issue. Advertising rates and sizes on application.

Change of Address—The publishers should be advised of change of subscriber's address about fifteen days before date of issue, with both new and old addresses given.

Nonreceipt of Copies—Complaints for nonreceipt of copies or requests for extra numbers must be received on or before the fifteenth of the month of publication; otherwise the supply is apt to be exhausted.

Entered at the Post Office at St. Louis, Mo., as Second-Class Matter

EDITORIALS

Editorials in Dental Journals

THE strength of a scientific magazine and newspaper is based largely upon the virility and power of its editorial department.

It is through this department that the policy and purpose of the publication is set forth to its readers, and through this department its greatest influence can be exerted. A weak, namby-pamby, vacillating editorial policy is indicative of a publication that stands for little or nothing in human affairs, and a publication with no avowed editorial policy or aim is nothing but an advertising makeshift calculated to catch the unwary and the unskillful merchant or manufacturer.

A true conception of the purpose of a magazine or newspaper is that they are intended to be a factor in educational uplift, either of the classes or the masses. If this conception be correct, then it is necessary for them to hold unswervingly to an editorial policy that gives a stamp of individuality to the publication.

News is not always educational in its truest sense but experiences and opinions of men with authority to speak and write are the great educational factors in the world.

In looking through the files of dental journals published in past years one is impressed by the absence of editorials. Plenty of dental news is in evidence and an abundance of original contributions but unless one was advised to the contrary he would naturally think that the dental journals of this and other countries published in the past had no definite policy, were not interested in educating their readers, and were run solely for commercial purposes.

Looking at the dental profession today one wonders if it would not have been further along in its scientific development if dental journals had arisen in the past to the supreme heights of their possibilities, and had boldly and with courage fought for better and still better dentistry, and for more thoroughly equipped dentists. If such had been the policies of dental journals in the past would dental schools still be run for personal profit, would students be matriculated with no regard for their fitness to take up a professional career, and would society have been cursed with the flood of bad dentistry, that all who understand conditions know has been foisted upon it? Timely and powerful editorials in the public press have helped in bringing about social reform. The *Journal of the American Medical Association* ten years ago attacked editorially the commercialized medical college, the low educational standard required of the medical matriculate, and the dishonest medical nostrums advertised as patent medicines through medical journals and the lay press. As a result of this propaganda for medical reform, the commercialized medical school has folded its tent and, like the Bedouin of the Desert, has stolen away. The matriculate in medical schools in this country must have educational achievements equal to the best universities in Europe, and the patent medicine faker has been driven from trench to trench, until nothing shields him now except the lowest types of the medical and lay press.

All this brought about in one decade! Medicine has advanced more rapidly in America during this time than in any country on earth and the incentive to this change has been supplied largely through the editorial department of the *Journal of the American Medical Association* and other self-respecting medical journals that have joined it in this uplift work. The crime of dental journalism in America is revealed by the refusal of members of the dental profession when they prepare research articles of especial value to let them first be published in dental journals, preferring to have them published in medical journals. Would this condition be, if there were dental journals that had, during years of service to the dental profession, developed an editorial policy that compared in power to that enjoyed by numerous medical journals of this country; that had stood for reforms of all kinds and character in dentistry; that had driven with relentless energy the unfit from the ranks?

Who is responsible for the opinion so prevalent today that a dentist is but little more than a refined plumber? Would this be possible if dental journals that have been published regularly for so many years had done all they could editorially to better dentistry? An editor of a scientific journal has an

opportunity to do much in an educational way. His duties may make him unpopular with those who have entered professional work merely as a cloak to graft and plunder; but to those in the profession who are trying to render service such efforts are understood and appreciated. It is pitiful to see a journal, published in the interest of a scientific profession, devote its energies to helping the members of the profession increase their monetary income and say never a word editorially that assists in the scientific development of the members of the profession.

There is more to dentistry than mechanics. True it is that man is the only animal that can use a tool; but scientific dentistry means more than the skillful use of instruments. There are problems in dentistry that need the careful consideration of the most scientific minds in the profession, and the opinion of such minds should be given outlet through the editorial departments of dental journals. Editors of dental journals everywhere should take up the scientific problems of dentistry and discuss them vigorously and scientifically. They should seek to arouse interest in problems that mean better dentistry, not more financial returns for bad dentistry. When one takes up dentistry or medicine as a commercial career he will be doomed to disappointment. But he will not fail to make a comfortable living in a dignified manner for himself and family. One of the arguments against dental journals owned and controlled by dental manufacturers and dental supply houses is that such organs cannot have a bold, vigorous, and progressive editorial policy. They are bound to be hampered by conditions pertaining to the business of which the journal is a part and such conditions will in ninety-nine cases out of one hundred stifle a broad-gauged, dominant educational policy. Can it be thought for a moment that the *Journal of the American Medical Association* could have become the power it is today for medical uplift had it been owned and controlled by a corporation that profited by selling or manufacturing supplies for physicians?

Because it was unhampered, it grew; until today it bears the distinction of being the most powerful medical journal in the world, and the association that it serves has done more for scientific medicine than any organization ever assembled in the history of medicine as a science. What dentistry needs is journals that will fight the cause of scientific dentistry editorially; that care not one jot or tittle for firm or manufacturing affiliations—if such affiliations throw a cloud upon the scientific conduct of the journal; that will hew to the line; that will inspect, expose, and condemn the unfit; that will fight against fraudulent articles that are advertised for use among the dentists or the laity; and that will educate the dentist how to do better dentistry and the laity to demand better dentistry.

The *Journal of the National Dental Association* has an opportunity now to render dentistry a real service—as a monthly publication it will be able to wield a tremendous influence in the uplift and betterment of the profession. It desires and should have the support of every state and local society. If it will adopt an editorial policy that is in keeping with the trend of modern dentistry, if it will bow to nothing but that which is for the benefit of the cause it represents; then dentistry will have a champion that will indeed be its friend.

Dental Fees

MUCH has been said and written in the past about fees for dental service. There are men practicing dentistry who believe in charging for their services at so much per hour; others believe in charging a fixed fee for calls, irrespective of service rendered; others believe in making a price when work is started and adhering to this, regardless of complications unlooked for when the case is started but that may arise during the course of the treatments; and there are still others who believe that prices should be charged in accordance with services rendered and the ability of the patients to pay; these also maintain that the value of services rendered cannot be ascertained until after the work has been completed.

With the first group we do not agree. Professional men should not estimate the value of their time at so much per hour. When they do this they class themselves with the mechanics and should be satisfied with mechanics' wages. Few dentists care to do this. The advocates of this plan talk much, but think little, and their vision is quite restricted. Their reasoning is illogical and will not bear cold and careful scrutiny.

With the second class we beg to disagree. Such a course is unfair to the patient and to the dentist. It gives the patient an opportunity to impose upon the dentist and certainly gives the dentist an opportunity to slough his work and impose upon the patient. These temptations should be removed as much as possible for the good of both parties.

With the third class we cannot agree because hard and fast rules can never be applied in professional work. You cannot look at a bird and tell how high it can fly. Neither can the dentist look at the condition of teeth that need dental service and tell the complications that may arise in the treatment of them. Nature is most uncertain in her treatment of Man. A seemingly simple condition may develop into one most grave and dangerous. Work that you thought might be completed in ten hours may take twenty; one must then either slough his work, be unfair to the patient and himself, or put in the time necessary to do the work well and be imposed upon.

With the fourth and last class we heartily agree. It is true that practicing dentists in the country must do much work out of which they get small returns but this they must be prepared to do, and must do it for sweet Charity's sake. In the cities this is not so necessary because the clinics at dental colleges and infirmaries take care of the poor. Those who are capable of paying for service rendered must be charged accordingly, not overlooking their ability to pay. Dentistry well done should be well paid for. To fill or crown a tooth well is worth about as much as to do a simple curetment, remove a clean appendix or repair a lacerated perineum; but in the one case $8.00, $10.00 or possibly $15.00 is charged; in the other, $50.00, $75.00, to $500.00. Take the nose and throat specialist; submucous resection, $50.00, $75.00, or $100.00; adenoids, equally as much; tonsils, as much or more. Surely a dentist to do his work well must have as delicate and refined a technic as the nose and throat operator but he gets much less for his work though his services to the patient may mean equally as much or more than that of the surgeon.

In rendering professional service there is but one guide. Do the best you can. Your ability to serve may be limited but those who possess two talents are not to be expected to do as much as those who possess ten. But condemnation rests forever upon those who possess ten talents and render a service equal to the ability of those who possess only two. The capable conscientious dentist knows what his services are worth and he knows the ability of his patients to pay. Conscience is a correct guide and he who follows it makes few mistakes. When you trust your purse to an honest man you do not need to count the pennies when you put it in his keeping and then again when it is returned. A patient in the hands of an honest dentist will be justly treated and rendered a just and honorable bill.

Propagandists who spend their time in helping the dentist to get more fees would be better employed if their efforts were directed toward helping the dentist do a better class of work, and thus merit greater fees. In the long run service plus attains its reward. The honest, capable dentist need not worry about financial returns. His chief concern should be more ability—more light. In the aggregate his fees will balance the service rendered when he does his best and strives to attain the true professional man's noblest aims.

Dental Judgment

JUDGMENT may be defined as the complete understanding of a situation or a condition and the will to apply one's ability to the successful management of the matter in hand. We speak of good and bad judgment, thus indicating one's ability, or inability to cope with situations as they arise.

Good judgment in the professional man is a valuable asset and one that is essential to the achievement of signal success. It is, however, an elusive goddess and can only be won after arduous efforts. Wishing and hoping for judgment is not enough. It must be sought for with untiring energy and a devotion to one's work. It must be nurtured in an atmosphere of courage and resolute will. Judgment never set the sign of its approval upon the coward's brow. He who would possess it must also wear the badge of absolute honor because judgment has nothing to do with the dishonorable man.

Good judgment to the dentist is his sheet anchor. With this trait well developed he need not worry because to him the crooked will be made straight, the tangle will unravel, the knot will be untied; but, good judgment in dentistry will only come after one masters the science, develops the courage to put his theory into practice, and has the integrity to resist the temptations that beset one to sacrifice truth and honor for financial gain. Judgment in dentistry, like judgment in surgery, is the child of wisdom; and to beget this off-spring one must constantly toil. A restricted vision is never conducive to sound and reliable judgment. One must see the ideal with the eye of imagination and then make the ideal a realization.

The dentist who is only mechanical in his work will never be reliable in his judgment. The vision is too restricted; the foundation is too frail. He must

know more than the mechanics of putting on a crown or filling a cavity. He must think logically, correctly. He must know chemistry, both organic and physiological. He must know physics and be well versed in the physical properties of metals. He must know bacteriology, and understand the principles of immunity. He most know pathology, both gross and microscopic. He must be a good physiologist and an accomplished diagnostician. He must be able to correctly advise his patients with reference to the bearing of dental conditions upon the health. He must know that an apical infection, untreated, will in time result in an endocarditis or an arthritis; that facial neuritis is most frequently of dental origin; and that septic pneumonia can frequently complicate an impacted, infected third molar. He should know when it is best to crown, fill, or extract; whether a plate or a bridge will render the most efficient service: and he must have sufficient psychic power to convince the patients that he knows what is best for them. He must be quick to recognize the defects of childhood and warn against adenoids, enlarged tonsils, and rickets. He should know the ultimate result of malocclusion upon the general health and either be able to correct it or advise reference to a specialist.

With a thorough knowledge of dentistry and its close relationship to general health, the dentist with judgment must also know how to successfully handle the patient. Knowledge is of no value unless it can be applied. A dentist's ability and judgment is of no value unless he is able to successfully handle his patients and convince them of the difference between good and bad dentistry. Quack dentists flourish because they are skilled in the art of handling people. They do bad dentistry but win financial success because they have the ability to impress the people. They sell their personality, not their technical skill. Christian Science is a bastard child of religion and science. Yet this cult has flourished, at the expense of scientific medicine. The healers have sold personality, not scientific ability. Dental judgment, therefore, must not be remiss in handling the patient. Tact and skill in this endeavor are just as necessary as the ability to successfully cope with the physical and pathological conditions as they are found.

To train students in order that they will develop a high degree of judgment should be the highest ambition of the dental teacher and the clinician. For this reason care should be exercised by universities in accepting matriculates and none but those with a broad preliminary education should be allowed to enter the dental ranks. A stream can rise no higher than its source, and the axiom still holds true that "you can't make a silk purse out of a sow's ear." You can't create a dental profession the members of which will have sound judgment and broad vision unless you carefully select those who enter its ranks.

Judgment in dentistry, as in surgery, can be attained; is necessary if the highest purpose of professional success is reached; and will, when achieved, twice bless, both the giver and the one who receives.

The Influence of Diet on the Development and Health of the Teeth

IN the November, 1916, issue of the *American Journal of Obstetrics,* Doctor J. I. Durand, of Seattle, Washington, presents the results of an investigation of the incidence of caries in teeth of 5000 children with reference to feeding in infancy. The highest percentage of caries was found among those fed on sweetened condensed milk. The percentage of caries among children who had been breast-fed was 28 or 29 per cent; among those fed on sweetened condensed milk 61 per cent. A well-balanced diet has a direct influence on the development and the health of the teeth. Breast milk or properly modified cow's milk with the early addition of vegetables has been shown to be a suitable diet; certain vegetables may be given as early as the sixth or seventh month of life and are a valuable addition, preventing rickets and spasmophilia. A second point of importance is to provide a diet that teaches the child the proper function of the jaws and teeth. For this purpose hard foods are useful, such as dry bread, celery, lettuce, etc. These give additional work to the teeth and jaws and further proper development. One of the points in the prevention of caries is that the last article eaten at a meal should not be as is customary, a soft, sticky, carbohydrate food, as cake, but some hard, cleansing food, as meat, a green salad, or some fibrous food. A hard food and vigorous efforts at mastication have a function in wearing down any roughness of the teeth. An examination of the skulls of primitive races gives confirmative evidence that the character of the food has an influence in the development and health of the teeth. A study of Maori skulls showed that in these the incidence of caries was only 0.76, while among Maori children today in a civilized environment the incidence of caries is 15 per cent. In the North American Indians the incidence of dental caries was from 1.0 to 3.9 per cent. It is shown to be low in other primitive races.

The International Journal of Orthodontia

Editor: Martin Dewey, D.D.S., M.D.

VOL. III | ST. LOUIS, FEBRUARY, 1917 | NO. 2

ORIGINAL ARTICLES

SOME CONSIDERATIONS REGARDING THE MOST SUITABLE AGE FOR THE TREATMENT OF CERTAIN FORMS OF MALOCCLUSIONS

BY AXEL F. LUNDSTRÖM, D.D.S., STOCKHOLM, SWEDEN.

THE question as to what age is the most suitable for the treatment of malocclusions of the teeth has been answered from two different points of view. If we judge from the professional literature on this subject it seems apparent that the school of the Occlusionists has proved victorious. As is well known, this School was founded by Angle, whose doctrines soon attained a dominating influence on our literature and possibly also our practice. This school asserts that normal occlusion is the ideal from the masticating standpoint as well as the esthetical. They claim an early treatment is always preferable, and should a facial disharmony arise as a consequence of the correction of the malocclusion, it will in time disappear during the further development of the face.

The other doctrine or school, which may be called the school of Dentofacial Orthopedia, has in some respects a quite different view concerning this phase of the subject. One of the teachings of this school is, that a denture, that has developed with the teeth in a most normal occlusion, may so interfere with the harmony of the facial lines that it is most desirable to correct this inharmony by means of an orthodontic treatment. C. S. Case, the founder of this doctrine, states that in a number of cases it is impossible to predict the facial type at an early age,[1] so it will be necessary to postpone the definite treatment until a later age than that considered advisable by the occlusionists.

As a general rule, the early treatment of the occlusionists seems the most rational, yet there are a few types of malocclusions, where a relatively late treatment is preferable. These cases have certain characteristics, that remind us of the problems of facial orthopedia. One of these is that it is possible only at a later stage to form a definite opinion of the true nature of the anomaly.

Another reason for postponement of treatment is that in certain cases the insufficient development cannot be sufficiently stimulated by mechanical means, unless it be accompanied by the correction of the permanent teeth. Certain varieties of mesioclusion and open bite have the former characteristic, opistognathy the latter.

It has long seemed to me a significant fact that we so seldom find in our literature records of treated cases of Angle's Class III. And it is still more rare to find the history of these cases several years after the treatments were finished. It seems highly improbable that those operators who feel it their duty to relate results of their work consider Class III cases as not of sufficient importance to be described. Is it quite wrong to conclude that difficult cases with good results are comparatively rare? But if we have studied the nature of these cases our unsuccessful results will not astonish us.

The variety of Class III malocclusion I have in mind is *progenie,* popularly, I believe, called "jimber jaw." It is characterized by an abnormally large growth of the mandible. Regarding the treatment of these cases, it has long been known that if it is postponed until a certain stage, they cannot be corrected by orthodontic means alone. But it also appears to be a prevailing notion among orthodontists, that if treatment is started at an early age the tremendous growth of the mandible may be prevented.[2]

For several years I have been convinced that this idea is erroneous. In cases of jimber jaw, the growth of the mandible is, at least to a very great extent, independent of the occlusal relations.* If this is not the case, how is it possible to account for a mesial malocclusion of a width of two bicuspids? If an interdigitation could prevent the forward, it ought to have occurred when the malrelation was the width of one bicuspid. A treatment that is finished before the relation between the upper and lower jaws has become definite will consequently only be a temporary improvement. If an early treatment of a Class III case has a successful and permanent result, it only proves that the particular case was not a case of progressive progenie.

In an excellent article Kantorowicz[3] has proved the hereditary character of progenie. By means of reproductions of portraits of members of the Hapsburg family he has shown how this anomaly has dominated in this family during several hundred years. With this in mind, it will certainly not astonish us if we are unable to combat this excessive tendency to abnormal growth of the mandible. It is therefore logical to postpone the final treatment until the abnormal mandibular growth has subsided. As soon as we find the mandible in a stationary relation to the upper jaw it is time to take into consideration the orthodontic treatment, in which case we should aim at a forward movement of the upper teeth. Attempts to influence the mandible with the chin cap or intermaxillary force have, it appears from our literature, not had the expected results. Nor has the method of extracting two bicuspids in the lower jaw and moving backwards the six anterior teeth been successful.[4] This is not astonishing, as the size of the mandible *in these cases* is determined by an abnormal

*It is a well-known fact that the growth of the mandible generally is perceptibly disturbed by the early loss of the first permanent molar. In cases of progenie the mandible grows independently, or at least relatively independently of early losses of these teeth.

growth of the body of the jaw and not by function; it would therefore be very strange if an extraction of teeth could obliterate this tendency.

As there are mesioclusions of every degree that have never been treated, it is evident that many of them could have been corrected with a permanent result, provided the treatment had been finished after the tendency to mesial movement had lost its activity. At present it appears to me to be impossible to decide, on the basis of a single examination, whether a case is of the progressive variety or not. As suspected symptoms I would suggest abnormal spaces between the lower permanent incisors. Another suspected symptom is when the apical arch of these teeth is large as compared with the coronal arch; yet another is a raising of the occlusion which results in an infraocclusion of the temporary molars. These three characteristics may be symptoms of an abnormal mandibular growth. If we find any of these symptoms in a Class III case we may suspect a case of progressive "jimber jaw." It would indeed be

Fig. 1.

very unwise to start treating a case like this without previously having informed the patient of the progressive nature of the deformity.

To better illustrate this it will be appropriate to discuss some cases from practice. Fig. 1 shows us the models of a case of a patient about nine years of age. It was treated without further delay and after six months the mesiodistal relations were corrected, and retainers with intermaxillary rubbers were placed in position. The patient was more or less under observation until all the deciduous teeth had been lost or extracted. Fig. 2 shows the condition present about three and a half years after the beginning of the treatment. The lower jaw had advanced considerably. The upper incisors were still occluding in front of the lower ones, but the considerable movement of the lower jaw had given the upper incisors a very slanting position. It was, therefore, necessary to again start treatment, and the occlusion one year later is shown in Fig. 3. No change in the mesio-distal relations could be detected one and a half years after the use of the intermaxillary elastics was discontinued. This case has been under more or less treatment during five and a half years, and I am convinced that the final result would not have been worse if the first treatment had been delayed a couple of years, or until the time of the shedding of

the last temporary teeth. Conditions present at the time of the first visit of the patient, which should have made the operator apprehend a progressive case, were the raising of the bite (see Fig. 1) that put the deciduous molars out of function, and finally the hereditary character of the anomaly, which could be traced back some one hundred and fifty years.

Fig. 4 is a case with a progressive tendency. The large apical arch of the lower teeth gives reasons to suspect this. An immediate treatment was, however, desirable on account of the insufficient space for the right superior

Fig. 2.

Fig. 3.

Fig. 4.

cuspid. Fig. 5 shows the case at the time of fixing the retainers; Fig. 6, one and a half years later; Fig. 7, another year later; and it is quite clear from the raising of the bite and the forward movement of the lower teeth, that the mandible, which is abnormally large as compared with the upper jaw, is in a state of forward growth.

Fig. 8 is a case of mesioclusion. The age of the individual was eight years, but as the abnormal spacing in the lower jaw seemed to indicate a progressive case, making a facial-orthopedic problem, the treatment was postponed until the remaining deciduous teeth had shed. The treatment was started two years later (Fig. 9); at this stage the tendency to abnormal growth, was

clearly discernible in the opening of the bite. The temporary molars, which previously had occluded sufficiently to grind them flat, were then in infraclusion. All the benefit that could have been effected at eight years can with all probability be effected at ten, the difference being that the patient is spared the wearing of appliances during these two years. It is not at all improbable that the mandible may still be in a state of abnormal growth; but the time for starting treatment was decided upon because of the necessity of gaining space for the unerupted upper permanent teeth; that is to say not because of Class III

Fig. 5.

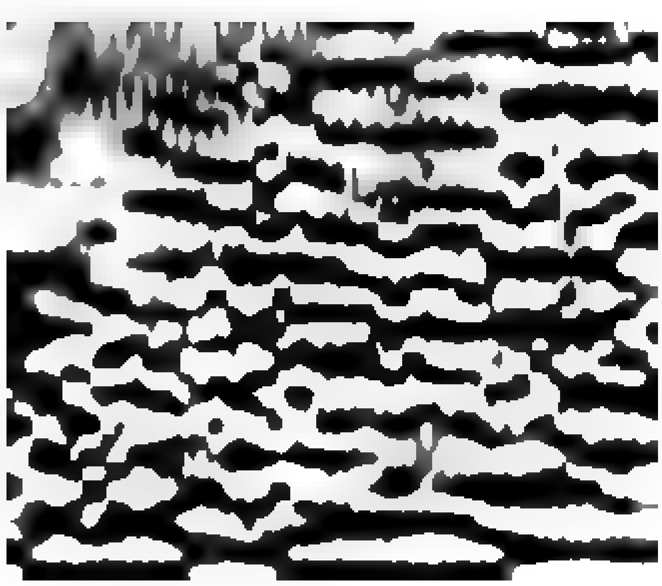


Fig. 6.

Fig. 7.

characteristics, but for the sake of correcting an abnormality, that may be found in all the three classes.

What has been said regarding the choice of age for treating progenie may also be applied to certain forms of open bite. Lind[5] has elaborately described the nature of these anomalies, and proved that they often are developed in connection with the eruption of the second permanent molars. It is therefore logical to have this circumstance in mind in prognosing the case and deciding on the time for starting treatment.

As has been stated above, we find in certain cases of mesioclusion and open bite an abnormal development of the mandible, which abnormal growth may be in operation during a long period, thereby frustrating our results if they have been attained before this abnormal tendency has ceased to be active. In

these cases a very early treatment is to be avoided. There are also a few other forms of malocclusion, that are better treated at a comparatively late age, but for quite different reasons.

In one of these forms there is a deficient development of that part of the upper alveolar process that contains the incisors, or the os incisivum. This deficiency is often found combined with other malocclusal factors, but when it is the only one it generally gives a sunken appearance to the upper lip. It seems to me that we should in our nomenclature for these cases use the old name opistognathy, as has recently been done by Greve.[6] As a general rule the treatment of opistognathy is a very slow proceeding, in which respect it dif-

Fig. 8.

Fig. 9.

Fig. 10.

fers radically from those cases of Angle's Class I, where the whole treatment consists of a simple moving of the upper teeth from lingual occlusion, which operation is said to have been effected in a very few weeks. Examples of this latter type have been published by Angle[7] and Dewey.[8]

To a superficial observer these cases are somewhat similar to opistognathy. One case that has been published in several editions of Angle's textbook, among others, in the seventh American edition, Fig. 352, and in the second German edition, page 507, Fig. 468, is a case of true opistognathy. Angle mentions this case as an example of the results of the early loss of the temporary cuspids. Of course, such a cause may have been active in this case, but the dominating factor in this case is the deficiency in the development of the intermaxillary bone,

which is also testified by the author, who makes special mention of this fact. This same deficiency may be found where the temporary cuspids were shed at their normal time (see Fig. 14). Figs. 10 and 11 are cases of opistognathy, in which the deficient development of the intermaxillary bone was the only anomaly, the occlusion being otherwise practically normal. In Figs. 12 and 13 there is other malocclusion. As a general rule the upper incisors occlude inside the lower ones, but an exception is shown in Fig. 14.

The treatment of a case like Fig. 10 would appear rather simple to the

Fig. 11.

Fig. 12.

Fig. 13.

superficial observer, as it would seem to be confined to moving the upper incisors into normal occlusion, thereby making sufficient space for the cuspids. This impression would be strengthened by descriptions of the treatment of cases of *apparent* opistognathy, like Angle's case mentioned above, that was finished after several weeks' treatment, no artificial retention being required. Instead of this, the movement of the malposed incisors in cases of true opistognathy is a very slow and tedious undertaking, and according to my experience, the bone development in the apical region after the treatment is not as great as is desired, even when the treatment is begun at a very early age. If we start treatment any considerable time before the permanent cuspids have erupted, the chief

difference will be a longer period of wearing appliances. If, however, the deficiency of the alveolar process is so considerable as to prevent the laterals from erupting, it is, of course, necessary to remedy this by an early expansion. But if conditions are relatively favorable, as shown in Fig. 13, a late treatment will save much time, and the final result will be the same. When I say late treatment, I mean, that instead of beginning as soon as the malocclusion can be detected, or about the age of seven, we ought to wait until the permanent cuspids are ready to erupt.

The history of the case shown in Fig. 12, may serve to illustrate the length of time the treatment of a case like this will consume if started early. During

Fig. 14.

Fig. 15.

four different periods the patient was wearing expansion arches, which, together with the final retention, gives a term of 5 years during which the patient was under orthodontic treatment. It seems probable, that if the treatment had been postponed a year or so, the final result would not have been worse.

The time of active treatment of the next case (Fig. 13) was one year. The patient was then 12 years, and it seems to be very clear, that if the treatment had been begun as soon as the malocclusion became apparent, which must have been four or five years earlier, the whole difference would have been that the patient would have been kept so much longer under treatment.

What has here been stated regarding the proper age for treatment of opistognathy can also be applied in certain respects to many cases with deep and narrow palatal vault, although the *possible* chances of broadening a narrow nasal space would justify an early expansion of the dental arch. I will, however, relate a case history, in which apparently the early treatment only lengthened the time of the orthodontic attention. The patient was 11 years. The palatal arch was very narrow and deep. The upper incisors slightly prominent and the lower arch in slight distal occlusion (Fig. 15). The width of the lower jaw was apparently normal. The patient had undergone operations in the nose and throat several times.

The upper arch was expanded and the other occlusional defects corrected. In spite of this, the upper bicuspids erupted in lingual occlusion. This necessitated a new expansion. The treatment was stretched over a considerable length of time, being prolonged by a circumstance which appears to be the rule in cases like this; namely, the delayed eruption of the upper permanent cuspids and bicuspids compared with the eruption of the corresponding teeth of the lower jaw.

It is interesting to note that the rhinological examination after the first expansion of this case revealed an abnormally narrow nasal space and a septum that was deflected, not in a superior-inferior direction, as would be expected, but in an antero-posterior direction.

The high and narrow palatal vault is often accompanied by other malocclusal details; as distoclusion, prominent incisors, and deep overbite. If this is the case the treatment ought to be begun as early as is desirable for these details.

We often find in our literature statements that to the mechanical expansion of the arch can be attributed divers remarkable effects on the nasal space. Some authors claim that broadening of the nasal space and straightening of the deviated septum is the direct result of the widening of the dental arch. This is, however, not yet scientifically proved. Cryer and Ottolengui have published cases in which an extreme narrowness of the nasal space was accompanied by palatal arches of fully normal width. These cases prove that the width of the nasal cavity and oral arch do not necessarily depend on the same cause. I have, myself, seen many cases of very deep and narrow palatal vaults, in which early mechanical expansion combined with early nose operations were still followed by a leptorhinical condition. The result of the expansion was chiefly *dental* and only, if at all, in a lesser degree *naso-palatinal.*

It is not necessary to here discuss those objections which may be raised in consequence of the observation that an expanded temporary denture may be followed by a broader permanent arch. The most of us have doubtless observed that this may often happen with an abnormally narrow arch that has never been expanded by mechanical means; and also, that an expanded temporary denture may be followed by a permanent arch with the distance between the bicuspids shorter than it was between the temporary molars immediately after the expansion. In accordance with these facts it seems as if we are justified in considering the lateral expansion of a contracted upper arch as a facial-

orthopedic operation and consequently delay the expansion until the bicuspids are erupted, always provided that there are no *other circumstances* that demand an earlier orthodontic treatment.

BIBLIOGRAPHY.

[1]Case, C. S.: The Question of Extraction in Orthodontia, Trans. Nat. Dental Assn., 1911.
[2]Angle, E. H.: Treatment of Malocclusion of the Teeth, Philadelphia, 1907; Die Okklusionsanomalien der Zähne, Berlin, 1913.
[3]Kantorowicz, A.: Die Progenie und ihre Vererbung, Deutsch. Monat. f. Zahnheilkunde, 1915, Part 3.
[4]Dewey, M.: Practical Orthodontia, St. Louis, 1914.
[5]Lind, G.: The "Open Bite" (Mordex apertus Carabelli): Its Etiology and Treatment, Trans. European Orthodontia Soc., 1913, reprinted in the International Journal of Orthodontia, 1915, No. 5.
[6]Greve, H. C.: Oesterreichisch-ungarische Vierteljahrsschrift f. Zahnheilkunde, 1915, Part 3.
[7]Angle, E. H.: Treatment of Malocclusion of the Teeth, Philadelphia, 1907, Fig. 272.
[8]Dewey, M.: Practical Orthodontia, St. Louis, 1914, Figs. 171*A* and 171*B*.
[9]Kemple, F. C.: A Consideration of the Question of Early Treatment of Malocclusion, Proc. Am. Soc. Orthodontists, 1914.

DENTAL ENGINEERING: EXACT ORTHODONTIA

By Rudolph L. Hanau, Consulting Dental Engineer.

In introducing Dental Engineering to the readers of the *International Journal of Orthodontia* in my article of Vol. II., No. 9, I indicated that I would publish from time to time my findings and results of investigation. That I have not had much to write for publication since is not due to a lack of valuable information. The basic principles of Dental Engineering are contained in a paper "The Hawley Arch Form Method Considered From an Engineering Standpoint and a Scientific Substitute," read before the Pittsburgh meeting of the American Society of Orthodontists, July 22, 1916. I stated in my first article in this Journal in September, 1916, that I would await the publication of that paper in the Society's organ before bringing any new material before the profession, as an understanding of the basic principles contained therein is necessary for the proper understanding of any new material. To my regret, that paper has as yet not been published, but I shall quote from it in this and later articles whenever it seems helpful to an understanding of the subject.

The practice of orthodontists and prosthodontists to produce a dental arch form to conform with certain geometrical figures may be justly described as an effort to make the foot fit the shoe.

The geometrical properties and mathematical proportions of objects in nature have always been, and correctly, used to classify them in all natural sciences, particularly in biology and mineralogy. However, to attempt to find, and dogmatically believe in a constant geometrical relation, where none exists, is not only unscientific but intolerable.

The problems in connection with the dental arch form are such that they must be solved on their particular merits.

The case against the Bonwill arch was summed up in the Pittsburgh paper as follows:

"The Bonwill arch and the Hawley method of construction, * * * * * which have served a purpose in orthodontic work, are based on the assumption that the anterior teeth are arranged on the arc of a circle having a radius equal to the sum of the mesio-distal diameters of the central, lateral, and cuspid. In exceptional cases this method fits, in some cases it very closely approximates the actual requirements. In most cases, upon investigation, we find that the practice of using the dimension of the three anterior teeth as the radius of the circle is absolutely erroneous.

There are two predominant factors in the determination of the dental arch form viz.,

1. Width of the C. C. Curves at the second or third molar.
2. The degree of the overbite (deep, shallow, and end-to-end).

The occlusal relation of the bicuspids and molars with their opponents is comparatively simple on account of the interdigitation of the cusps. Through them the exact distance between the upper and lower C. C. Curve is fixed. A change in the radii of curvature of both C. C. Curves will bring both upper and lower into their proper occlusal relation. A small variation may be obtained by rotating these teeth. The most difficult problem we are confronted with is the overbite. It is possible to arrange the anterior teeth on different and differently related C. C. Curves and yet comply with our known rules of occlusion—mechanically and kinematically at least. This is so because the accepted rules of occlusion involve too many unknown variables of physical and physiological character. It has been accepted that teeth are held in their position by forces of occlusion and these forces are defined as those factors which cause the teeth to assume and maintain their proper position in the line of occlusion. Quoting from one of the best texts on the subject—Dewey's "Practical Orthodontia"—these forces of occlusion are:

1. Normal cell metabolism.
2. Muscular pressure.
3. Forces of inclined plane.
4. Normal approximal contact.
5. Harmony and size of arch.
6. Atmospheric pressure.

In the determination of the dental arch, I will frankly admit that I only consider these factors when manifested as physical conditions, for the reason that I have not yet found anybody who could give me their definite value, not to speak of their definite interrelation.

Furthermore, the manifestation of any or all of these factors should not influence too much the regulation of the teeth, since our understanding of the interrelation of these factors is so meager.

In normal dentures and in cases of "set malocclusion,"* where conditions have become permanent, all of these forces, assuming their existence, are in

*By "set malocclusion" is meant those cases of malocclusion in which the teeth have become locked in positions of malocclusion by the various forces of occlusion.—Editor.

equilibrium; i.e., the sum of horizontal and vertical forces and moments equate to zero.

$$H = 0$$
$$V = 0$$
$$M = 0$$

In the case of "set malocclusion," it is the problem of the orthodontist to find a new equilibrium, by positioning the teeth in such a manner, that the disturbing influences on neighboring bone and tissue will be eliminated; i.e., compliance with physiological requirements.

Our vague understanding of the interrelation of the forces of occlusion accounts for the many disappointing observations when releasing retention. The teeth often "slip right back," even if retained for an apparently sufficiently long time. When this occurs, we have sufficient data to determine the reaction of the forces that have caused the "slip" and we can logically revise the arch form to meet the physically manifested conditions. It will also be well to check up the original survey and proposed arch form, and to change the C. C. Curves to accommodate the new findings.

Thus, since in the determination of the arch as far as the occlusal relation is concerned, one and the same set of teeth may be arranged on several arch forms, the problem of the orthodontist becomes one of geometrical, kinematical and mechanical considerations.

The orthodontist of today, lacking a knowledge of these essential aids of orthodontia, resorts to extended trial and error methods and "good judgment," and pins his faith to machines, appliances and empiric formulas. It is really very fortunate that, often, good results are attained by these methods. However, even in the successful cases, the work is uncertain and of "cave-man erudition;" and often extends over a period of several years.

The constant quest for machines to supplant logical analysis by orthodontists is well exemplified by a personal experience of the author.

When a dental surveying apparatus which I invented was brought on the market, some commercial genius spread the tale that the apparatus determined the occlusion of the teeth. Since then, I have applied for patents for an "Apparatus for Determining the Occlusal Relation of Teeth" and a very similar machine has been offered to the profession by another party. Both apparatus are useful for demonstrating and similar purposes, but they cannot be used for the determination of accurate occlusal relation of the teeth.

If it would be possible to classify our patients as belonging to a certain race or family among whom certain arch forms predominate, then it would be comparatively an easy matter to use such data for selecting a possible arch form nearest to the type desired by simply computing the tooth material on hand.

The writer has good reasons for believing that the different types of arch forms, found among the different races, types, sexes, and other classifications are mainly due to the ratio of the lower to upper anterior tooth material and the depth of the overbite.

There also exists, without doubt, a definite relation between the shape of the skull and the dental arch form. To establish this relation, the writer

proposes that measurements also be made of the posterior teeth and their relation to the rise of the posterior ends of the C. C. Curves, the latter probably being a factor in the development of the bone.

Very early in my investigations, I have found that a lateral widening of the posterior ends of the C. C. Curves is equivalent to a raising of the posterior ends of the C. C. Curves. This finding would indicate that the occlusion of the same set of posterior teeth may be obtained by narrowing, and simultaneously raising the posterior ends of the C. C. Curves or by widening and simultaneously lowering the posterior ends of same curves.

Another method of changing the arch form, without interfering with the occlusal relation, is moving an entire region bodily or rotating it around an axis or both, simultaneously or successively. This applies to any particular region of the denture, or to the denture as a whole. When rotating or bodily moving one region only, the influence of such procedure on the neighboring regions must be very carefully considered.

When speaking of bodily moving, or revolving any regions, it is assumed that the relation of the individual teeth or their axes to the C. C. Curve has not been interfered with. If we also change the relation of the axes of the teeth to the C. C. Curves, another complication arises. When the molars and bicuspids are thus concerned, it will be observed that the inclined planes of the cusps assume abnormal contact and an error, therefore, will immediately be apparent. The rotation of the anterior portions of the C. C. Curves with the teeth around a common axis does not alter the relation of the individual, adjoining, and opposing teeth within the region. Revolving the C. C. Curves in their anterior portion, and moving the teeth bodily only, involves a pronounced change of the occlusal relation of the anterior teeth. A similar result obtains when rotating the teeth around their mesio-distal axis without changing the C. C. Curves. These factors encompass the problem of the overbite. A later article will be devoted to a more elaborate presentation of these intrinsic facts.

HISTOLOGICAL STUDIES OF THE DEVELOPMENT OF THE ALVEOLAR DENTAL LIGAMENT OF YOUNG RHESUS MONKEYS

By F. Hecker, B.S., D.D.S., A.M., M.D., Kansas City, Mo.

Director of Research Laboratory of the Dewey School of Orthodontia, Kansas City, Mo.

HISTOLOGICALLY the alveolar dental ligament and the periosteum of the alveolus are alike. The author does not believe that without knowing the location of the field microscopically one can differentiate these tissues. A careful examination of slides in the author's possession which are longitudinal sections, reveals no line of differentiation between the alveolar dental ligament and the periosteum, but instead shows that the periosteum and the alveolar dental ligament of the deciduous tooth are histologically the same. In addition to this observation, one also learns from the slides that the fibrous capsule which surrounds the developing tooth is also a tissue of the same type as the periosteum of the alveolus.

Anatomically let us trace the periosteum in its course from the alveolus. At the gingiva of the tooth, we observe that the periosteum passes across the space between the alveolus and the neck of the tooth and that some of the fibers of the periosteum are turned downwards. Directly below the gingiva we find the alveolus and the fibers of the alveolar dental ligament in this area take on a definite angle and this angle is maintained practically to the apical area of the root of the tooth. In the actual apical area of the root of the tooth are the fibers of the alveolar dental ligament; although some are attached to the root of the tooth, many of them are parallel to the root of the tooth and occasionally we note a bundle of fibers projecting out in the immediate alveolus.

Continuing our study of the alveolar dental ligament we learn that some of the fibers of the alveolar dental ligament in the apical area of the deciduous tooth unite with the fibrous capsule of the permanent tooth. Thus, by this union of the fibers, we practically have a continuation of the fibers of the alveolar dental ligament of the deciduous tooth with the fibrous capsule. Just at what time the union takes place the author does not know and further it is not necessary, for this paper is not dealing in the early embryonal stages of the development of the alveolar dental ligament. Anatomically, the alveolar dental ligament is ligamentous. Other functions which the alveolar dental ligament possesses are that it is one of the avenues of vascularization of the alveolus in the area with which it comes in contact and it is also one of the avenues of vascularization of the cementum of the root of the tooth. From the foregoing statement the reader must not infer that the alveolar dental ligament is the only avenue of vascularization of the alveolus or the cementum; for the author does not believe it is. In addition to the foregoing functions of the alveolar dental ligament, it has the same role to the alveolus forming the root socket as the periosteum has for the bone; namely, that it is a limiting membrane for the alveolus. Likewise, the alveolar dental ligament is a limiting membrane for the limited bony covering of the root of the tooth.

Let us now commence the study of photomicrographs that show the root of the deciduous tooth, the alveolus, the alveolar dental ligament, the cementum, and the relative position of the cusp of the permanent tooth to the root of the deciduous tooth. In Fig. 1, at 1 is shown a Haversian canal of the alveolus; 2, the alveolus; 3, the alveolar dental ligament; 4, the dentine; 5, the cementum; 6, the alveolar dental ligament covering the absorbing area of the deciduous root. At 7 is shown an area at which there is a separation of the fibrous capsule which surrounds the developing tooth; 8 shows an area, which, prior to decalcification, was partially occupied by the enamel of the crown of the developing tooth; 9 shows a small portion of the lymphoid pad and fibrous tissue which approximately

Fig. 1.—Showing the relative position of the root of the deciduous tooth and the crown of the permanent tooth and all of the immediate dental tissues.

covers the cuspal portion of the developing tooth; 10 is one of the cusps of a permanent premolar.

This picture shows very excellently the position of the alveolar dental ligament of the deciduous tooth and also shows the position of the alveolar dental ligament covering the end of the root, and at 7 is shown the fibrous capsule which surrounds the developing permanent tooth. The fibrous capsule which surrounds the developing permanent tooth unites with the alveolar dental ligament of the deciduous tooth; for evidence upon which this statement is made, see Fig. 6 at 7, and also Fig. 8 at 3. Thus by this evidence with the low power of magnification, we learn that in the process of the development of the permanent tooth and the absorption of the deciduous tooth, the alveolar dental ligament and the periosteum

of the alveolus are continuous. To substantiate this statement, let us now study Fig. 2.

In Fig. 2 we observe at 1 the alveolus, at 2 a continuation of the fibrous capsule that surrounds the developing tooth, at 3 is shown the columnar epithelium covering of the fibrous capsule that faces the enamel of the tooth, and at 4 three Haversian canals are shown. This picture shows us the continuation of the same type of tissue as the periosteum of the alveolus of the alveolar dental ligament that surrounds the root of the deciduous tooth. Let us now continue our study of the fibrous capsule which surrounds the developing tooth in the next picture (Fig. 3) which shows the future gingival attachment of the alveolar dental ligament at the neck of the tooth.

Fig. 2.—Showing a continuation of the fibrous capsule surrounding the developing tooth that eventually becomes the alveolar dental ligament.

Beginning at 1 in Fig. 3 is shown the alveolus, directly below the pointing line 1 is shown a Haversian canal. At 2 is shown the further continuation of the fibrous tissue of the fibrous capsule; at 3, the columnar epithelium covering of the fibrous tissue of the fibrous capsule which faces the enamel area of the developing tooth. At 5 is shown the incomplete attachment of the alveolar dental ligament of the future neck of the tooth of some of the fibers of the fibrous tissues composing the fibrous capsule. Lying directly to the left of this area one notes other fibers of the fibrous capsule which have separated from the bundle of fibers noted at 5. At 6 is shown the dentine of the tubuli standing out in bold contrast. At 7 the odontoblasts are distinctly shown, and at 8 the blood vessels of the pulp of the tooth are shown.

This picture shows very nicely the relative position of the fibrous capsule of the developing tooth which surrounds the crown, and its position at the future

Fig. 3.—Showing the fibrous tissue of the fibrous capsule, the columnar epithelium, and the future neck of the tooth, and the attachment of some of the fibers of the fibrous capsule.

Fig. 4.—Showing the apical area of a developing root of the tooth and the immediate dental tissues.

neck of the tooth. Histologically this tissue is the same as the periosteum of the alveolus or the alveolar dental ligament which surrounds the root of the deciduous tooth.

In the next picture, (Fig. 4) is shown the extreme apical area of the root of a developing premolar. Beginning at 1 the pulp of the tooth is shown; 2 and 2′ are the dentine; 3 and 3′ show the odontoblasts; 4 and 4′ show the fibrous capsule surrounding the developing root, and at 5 and 5′ the fibrous capsule at the extreme apical area of the developing root of the tooth; 6 is the alveolus.

Fig. 5.—Showing the fibers of the periosteum and alveolar dental ligament.

Fig. 6.—Showing the point of union of the alveolar dental ligament and the fibrous capsule which surrounds the developing permanent tooth.

This picture shows that the alveolar dental ligament and the fibrous capsule which surrounds the developing tooth are continuous to the extreme apical area of the developing root of the tooth. Thus, from the foregoing pictures, we learn that the periosteum covering the alveolus is continued at this time in the develop-

ment of the root of the tooth in the young rhesus monkey to the apical area of the developing tooth.

Having shown the foregoing pictures of low power, let us now study some photographs which are of a higher magnification. In Fig. 5 is shown an area in the immediate vicinity of the gingivus of the deciduous tooth. Beginning at 1 is shown an area, the fibers which are the direct continuation of the periosteum of the alveolus; at 2, is shown the cementum of the deciduous tooth; at 3, the cementum of the root of the deciduous tooth; at 4, cross section of a blood vessel in the substance of the alveolar dental ligament; directly below at 4, is shown an area in which one notes that the fibers of the periosteum are turned at an angle, and it is at this point that the author no longer terms the tissue the periosteum, but instead—the alveolar dental ligament. Histologically the structure of the tissue is the same as the periosteum.

Fig. 7.—Showing an area in which the fusion of the alveolar dental ligament and the fibrous capsule surrounding the alveolar dental ligament is complete.

In the next picture, which is a continuation of the fibers shown in Fig. 5, is shown an area at the end of the root of the deciduous tooth. Beginning at 1, we observe the lacunæ of the cementum of the deciduous tooth; at 2, the cementum; at 3, the dentine; at 4, the alveolus; at 5, the alveolar dental ligament of the deciduous tooth; at 6, an area presenting the fibrous capsule which surrounds the developing tooth; and at 7, is shown the point of union of the alveolar dental ligament of the deciduous tooth and the fibrous capsule which surrounds the developing tooth.

In this next picture we are bearing out a previous statement, and the evidence being a photograph, we must at this time accept the previous statement. In the next picture, which is a continuation of Figs. 5 and 6, is shown a field in which the fibrous capsule and the alveolar dental ligament are one and the same tissue microscopically and anatomically.

Beginning at 1, which is the dentine in the deciduous tooth, and advancing to

2, is shown the alveolar dental ligament of the deciduous tooth. At 3 is shown an area in which the fusion of the tissues is complete while at 4 a slight separation is noted. This separation of the tissues is the result of the pulling apart of

Fig 8.—Showing the future gingivus of the developing permanent tooth.

Fig. 9.—Showing the fibrous capsule at the future gingival area.

the tissues, and at 5 is shown the space which is occupied by the enamel of the permanent tooth.

In Fig. 7 we have substantial evidence that the fibrous tissue of the capsule which surrounds the developing permanent tooth is of the type known histo-

logically as the periosteum of the alveolus; and further, that the tissue is a continuation of the periosteum.

In the next picture (Fig. 8) is shown a field which presents the future neck of the permanent tooth and also its gingivus. At 1 we note the area occupied by the enamel; 2 is the future gingivus and point of attachment to the periosteum; 3 is the dentine; 4 is the alveolar dental ligament, 5 is the alveolar border of the alveolus.

In the next picture (Fig. 9) is shown a higher magnification of the same field as shown in Fig. 8. At 1 is shown the future gingival attachment of the periosteum; at 2 is shown the cementum, and directly to the left of the heavy shaded cementum, some cemental cells are shown. This row of cells can be traced by careful focusing to the extreme apical area of the developing tooth. At 3 is shown the alveolar border; at 4, the future alveolar dental ligament.

From the foregoing pictures we learn that the alveolar dental ligament of the tooth and the periosteum of the alveolus are histologically the same in type; and that the alveolar dental ligament is a direct continuation of the periosteum into the root socket; and, further, that the fibrous capsule which surrounds the developing permanent tooth is a direct continuation of the alveolar dental ligament of the deciduous tooth, and, therefore, the fibrous capsule is a continuation of the periosteum. We also learn that the function of the alveolar dental ligament is that of a ligament, also that it is a limiting membrane, and that it is not concerned in the development of the cementum or the alveolus directly. But, as previously stated, it limits the growth of the cementum of the root of the tooth and the alveolus that forms the root socket.

TREATMENT OF A CASE OF EXTREME MAXILLARY MALFORMATION IN ADULT LIFE

By L. J. Huber, D.D.S., St. Genevieve, Mo.

FIGURE 1 represents the unfortunate condition of a lady who was permitted to reach adult life with an extreme type of maxillary malformation and labioversion of the upper incisors. This condition seriously impaired the normal masticatory function in its initial stage and resulted in a repulsive type of facial deformity, with the central incisors exposed and a marked eversion of the lips.

Properly administered orthodontic treatment in her youth, would have arrested the malformation and corrected the malocclusion and the accompanying facial deformity. In reply to her repeated inquiries, the presumably authoritative, though unscrupulous, advice was, that she would outgrow her deformity in a few years. In this instance the patient had to learn through bitter experience, as many others have, the truth of the statement that, "Malocclusion and its accompanying deformities grow steadily worse; nature and time rarely exercise a corrective influence," as Lischer points out in his admirable book, "Orthodontics."

The patient in her 28th year, painfully conscious of her malocclusion and facial deformity, applied to the writer for treatment. After a consideration of the nature and extent of the abnormality to be corrected, and the condition to be established, it was evident that any effort to bring about the desired result by orthodontic treatment would prove futile. However, the possibility of surgical means as an effective procedure suggested itself.

Following the administration of a local anesthetic, the upper central and lateral incisors were extracted, the overlying soft tissues with the periosteum dissected back about, 10 mm. of the labial and about 8 mm. of the lingual process curetted off, thus presenting a rounded surface. Next the interproximal points of gum tissue were clipped off allowing the tissue to meet in apposition.

Fig. 1. Fig. 2.

Surgical stitches were employed for the purpose of holding the tissues in position; these were removed after four days.

After a period of three weeks, conditions were such as to permit the insertion of a four tooth individual saddle bridge with inlay attachments to the cuspid teeth. The results obtained can be seen in Figure 2, a marked reduction of the labial arch; not a normal, but a vastly ameliorated occlusion. The patient can now bite off foods; upon closure of the jaws, the lips meet in apposition, and a marked degree of improvement is noticeable in the profile.

One year has elapsed since the above operation was performed, and in that time the patient has twice reported for observation of conditions. The results obtained are permanent and satisfactory in every respect; and in my opinion, this is the proper method of treatment for such conditions in adult life.

THE USE OF .0225 ALIGNMENT WIRE

By Allen Holman Suggett, B.S., D.D.S., San Francisco, Cal.

THERE is a prevailing idea, that a great deal of force is necessary to move teeth and expand arches. If results are not obtained immediately, it is because there is not enough force. Therefore more force is applied. We have become accustomed to the action of the 16 gauge wire, and it is hard to conceive of tooth movement being produced with anything less rigid.

THE .030 WIRE.

When the .030 wire was introduced, some three or four years ago, and the claim was made, that with it the teeth could not only be moved but moved bodily, and whole arches could be expanded, many shook their heads in doubt for it seemed absurd. Experience has proved that all this can be done with the .030 wire. Articles in the different journals, however, show that many of the leading orthodontists are using much larger wire, and are very slow in accepting .030 Some are using large wire with pins and tubes to move only one or two teeth at a time—just cutting off an inch of the dog's tail at a time.

THE .0225 WIRE.

I stated in my paper at the Pittsburg meeting that there was a tendency to use much smaller wire and that I thought we would come to use 0.225.

After a year's trial of the 0.225 wire, I am so pleased with it that I have changed all my .030 wire for the smaller one, because in using the .030 with direct attachments to all, or nearly all of the teeth, it was soon apparent that it was too rigid.

LARGE AND SMALL WIRES PRESENT DIFFERENT PROBLEMS.

An arch wire that is attached only from molar to molar, presents a very different problem from the wire with direct attachments, stationary anchorage, if you please, to eight or ten teeth. A wire that has four inches between the attachments presents different problems from the one with attachments every half of an inch. For such use, the .030 wire was too rigid, and I began using .0225 wire after seeing Dr. Robinson's clinic. Since then I have used only the .0225, and am very much pleased with it, for it enables me to discard the D band, with all of its objectionable features, including the sectional arch wire.

SIMPLICITY OF THE .0225 WIRE.

This wire can be used with the Robinson attachments or with the pins and tubes, or with both. In very close bites of the molars, the Robinson attachments are especially indicated. The technic can be demonstrated better by illustrating how to proceed with a given case.

A CASE FROM PRACTICE.

Case 1, Mr. B. B., age 11. Bands were made for the upper molars of material consisting of platinum 6%, gold coin 94%, soldered with platinum gr.

½, silver gr. 1, gold coin dwt. 1. The bands are 32 gauge thick and $\frac{3}{16}$ wide. After burnishing the bands to the teeth, gold-platinum tubes, gauge .023, length $\frac{5}{32}$ are soldered vertically, slightly anterior to the middle of the buccal side of the bands, with 16 solder, and a spur of .030 on the anterior lingual side to rest against the baby molar.

Bands of the same material, but of 38 gauge, are made for the baby cus-

Case 1

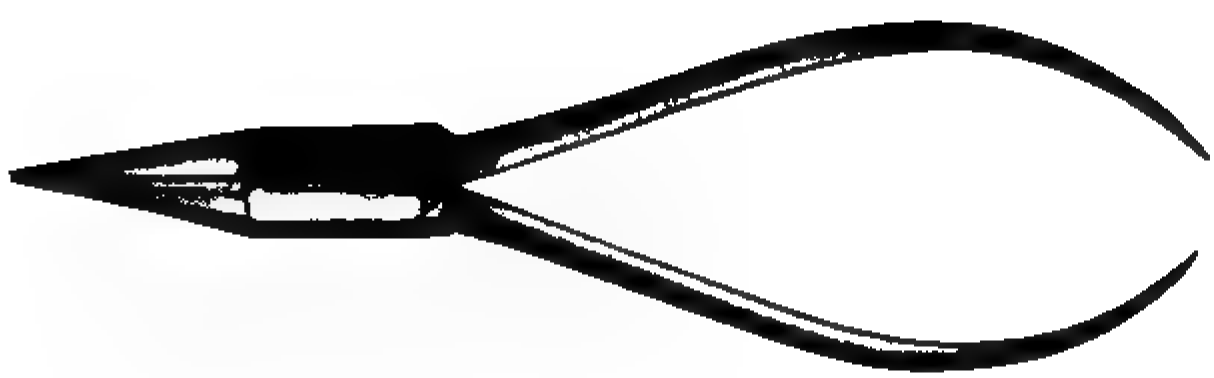


Fig. 1.—Sharp-nosed pliers for bending .0225 wire.

Fig. 2.—After first bend is made in wire

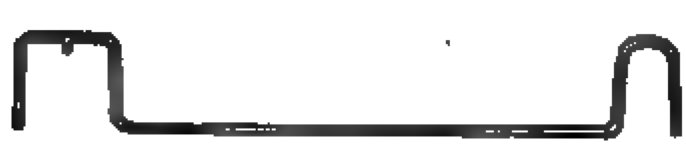


Fig. 3.—Second step.

pids, with a spur to rest on the lingual of the first baby molar. The tube should be placed slightly to the distal of the middle of the tooth, to take care of the side pressure necessary to carry the baby molar.

Bands of 38 gauge are made for the centrals and laterals with the tubes slightly to the distal of the middle, as these teeth are to be rotated. After the bands have been boiled and the tubes filled with soap or wax, cement them on the teeth with a good quick setting cement.

CONSTRUCTING THE ALIGNMENT WIRE.

The next step is the shaping of the alignment wire and soldering the pins. It is a combination of platinum and gold, .0225 in diameter, and can be gotten from the Blue Island Specialty Co., The S. S. White Co., and other dealers, under the name of pin tube, or orthodontic wire.

Take a piece of wire about six inches long, and with pliers (Fig. 1) bend the end as shown in Fig. 2. Then place this right angle in the left molar tube, and after getting the length of the loop, make a scratch on the wire to indicate where the next pin should be soldered (Fig. 3). Pins $\frac{3}{16}$ inch long, cut from the same .0225 wire, with a small sliver of 16 gold solder melted to one end, should be at hand ready for use. Dip the end of this pin in S. S. White flux, and solder it to the wire as indicated by the scratch. A jig, or any other

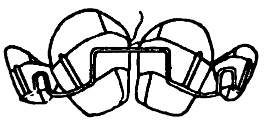


Fig. 4.

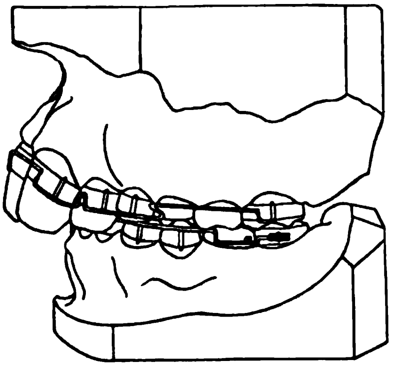


Fig. 5.

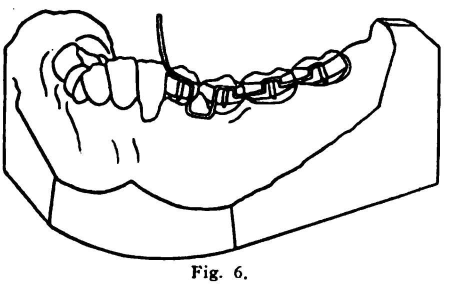


Fig. 6.

mechanical apparatus, is absolutely unnecessary, unless the operator is pretty shaky. The jig was thought to be necessary when using the stiff .030 wire, which was too rigid to bend and adjust if the pin was not absolutely in the correct position. In making the loop just distal to the cuspid, shape it so that it will act as a hook for the Baker anchorage. Either do this, or solder a small piece of wire for this purpose. Make your next loop and get your measurement for the next pin, as before, but provide for the rotation of the centrals and laterals as shown in Figs. 4 and 5, where the loop rests on the mesial corner of these teeth.

PUTTING THE ALIGNMENT WIRE IN PLACE.

After boiling the appliance and slightly bending the pins so they will bind in the tubes, and shaping it to as near an ideal curve as practicable, it is ready to slip in place. There is no need of adjusting it again for several months, and possibly not at all, for there are the hooks for Baker anchorage, the spring

for the necessary expansion, and the upward spring necessary to carry the incisors upward and reduce the excessive overbite, as shown in Fig. 5.

DIFFERENT PROBLEM IN THE LOWER ARCH.

In attaching the lower, the close bite of the molars presents another problem. The pins and tubes are indicated, but it is an ideal place for the Robinson attachment, which requires less vertical room, Case 1, and Fig. 5.

The molar bands are fitted just as the upper were, with lingual spurs to carry out the baby molars. All the other teeth on the lower arch are banded and tubed, and the wire and tubes adjusted just the same as on the upper, except for the Robinson attachment on the molars, and that the wire is not sprung in to attach to the right lateral, but a rubber is looped over it until it is a

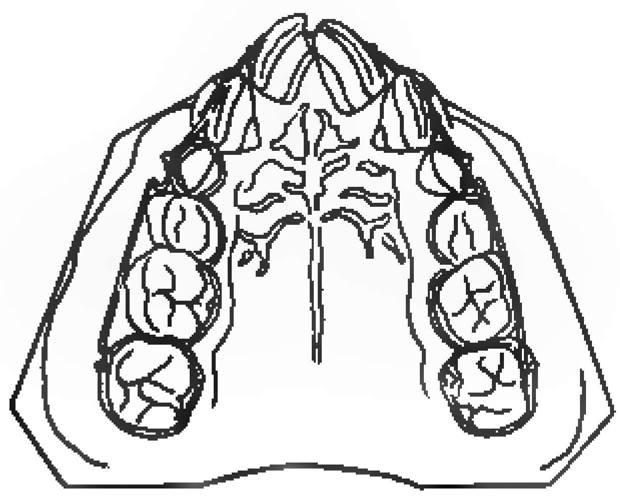


Fig. 7.

Fig. 8.

little nearer the line, when the pin can be slipped into the tube and the root movement is made in unison with the others (Fig. 6).

A hook for Baker anchorage is soldered on the wire just anterior to the molar attachment, and this arch wire is ready to slip into place (Fig. 5). Figs. 7 and 8 show the occlusal view.

ADJUSTING.

The loops can be spread without removing the wire, but after two or three such adjustments, the wire should be removed for fear it is out of alignment, corrected and put back. When the case is near completion, some of the bands may be removed to allow any over spacing to close up, and the rest of the appliance left in place as a maintainer.

A CASE OF NEUTROCLUSION.

Case 2, Miss V. B., age 8, is quite a unique case of neutroclusion, with very narrow arches (Fig. 9) and the spaces for the lower cuspids entirely closed. All the teeth were banded for bodily movement. The loops between the laterals and the baby molars should have enough wire to provide room for the cuspids when the wire is partly or nearly straight.

Case 2.

Fig. 9.

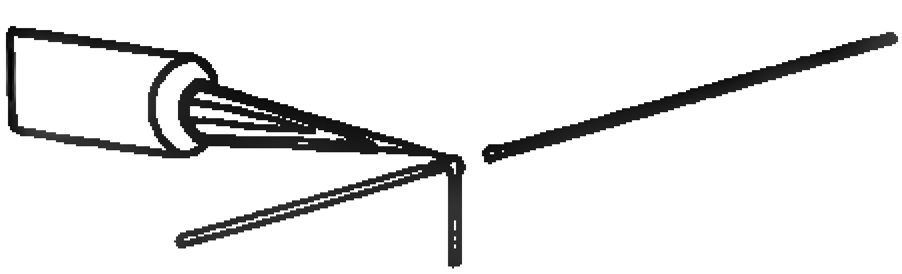


Fig. 10.—Shows method of soldering a break near one of the pins. Let the pin hang downward and the solder will hold it in place while the union is being made with the other piece.

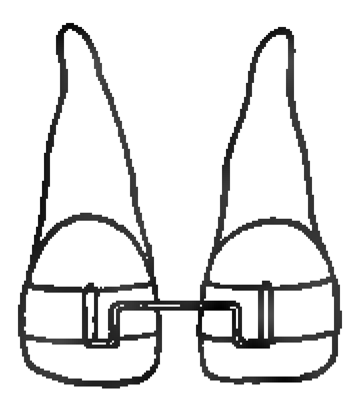


Fig. 11.—Shows appliance for closing a space, also to rotate one or both teeth.

The upper alignment wire was adjusted with enough spring to carry the case nearly to completion. The lower requires a little enlarging of the loop every month, but the pressure should not be increased fast enough to cause tipping. Go slowly enough to keep the masticating surfaces in good contact, when the jaws are closed, but not to move the crowns faster than the roots.

NOT VITAL THAT TUBES SHOULD BE PARALLEL.

All tubes should be as near parallel and on the same horizontal plane as pos-

sible, but this is not vital. Neither do the pins have to be at exactly the proper distance, because the loops will allow of considerable change. It is also quite apparent that if the tubes were exactly parallel and on the same horizontal plane, on teeth that were inclined toward each other, they would not continue in that relation long after correction was begun.

SOME OF THE ADVANTAGES OF THE .0225 WIRE.

It is, therefore, quite apparent that this small wire presents a much simpler problem to master, in making the appliance, in adjusting it, and in repairing it if broken. It is so pliable that one can spring it to a tooth that is far out of line, and slowly and comfortably move it where desired. The large wire is too rigid to do this without many adjustments. The small wire will allow of much more play and freedom, and a more normal bone development. The D band can be eliminated, with the buccal tubes and the screw, the three piece arch wire and the special pins at 40 cents each, and the jig. Thus we have a smaller, neater appliance that is easier made, and which keeps all the teeth moving at the same time.

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

JAMES DAVID MCCOY, D.D.S., EDITOR
LOS ANGELES, CALIF.

X-RAY MACHINES

BY JAMES D. MCCOY, D.D.S., LOS ANGELES.

Professor of Orthodontia and Radiography, College of Dentistry, University of Southern California.

IT is no longer necessary to advocate the use of the x-ray in any of the various branches of dentistry, as the profession has at last awakened to the fact that this agent is not to be regarded otherwise than as a necessity. As a result of this conclusion, most up-to-date practitioners are contemplating the installation of x-ray apparatus as a regular part of their office equipment. While many are actually taking steps in this direction, the majority are putting off the actual purchase of equipment, as they are more or less at sea concerning the apparatus which is best adapted to their needs. This is due for the most part to the fact that the dentist of today is offered such a wide choice in the way of equipment, and also to the fact that some representatives of manufacturers of x-ray apparatus are so extravagant in their claims, that the prospective purchaser hardly knows what to believe and what not to believe.

Of course, the first requisite of the dental x-ray laboratory which the dentist must consider is the so-called x-ray machine. Inasmuch as this requisite is such an important factor, the author has deemed it expedient to discuss the subject with the hope that by properly classifying them, he may make it possible for his readers to more intelligently cope with the problem of the selection of this particular piece of apparatus.

The object of the so-called x-ray machine is to produce a high potential electric current which can be passed through the x-ray tube and thereby produce the x-rays. The ordinary lighting current of 110 volts is inadequate for this purpose, as it is of far too low potential (voltage) to pass through the tube, as the vacuum offers a resistance which to the ordinary current amounts to an absolute nonconductor. We are obliged, therefore, to make use of some electrical means whereby the ordinary current may be "stepped up" to a high voltage, a voltage we will say of from 75,000 to 150,000 volts.

To do this we must make use of one of the electrical machine which can generate such a current by utilizing the principle of electro magnetic induction.

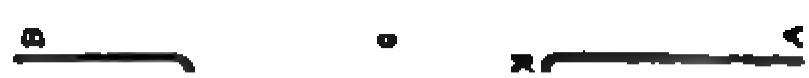


Fig. 1.—Diagrammatic illustration of the essential parts of an induction coil. *A'* and *A* are the terminals of the "primary coil." *D* represents the windings of the "primary" about the magnetic core *C*. The insulating medium between the "primary" and "secondary" is shown at *E*. The windings of the "secondary" coil are designated by *F*, and the "secondary" terminals by *B* and *B'*.

Such machines are classified under three headings:

1. The Rhumkorff, or induction coil.
2. The Tesla, or high frequency coil.
3. The Interrupterless transformer.

THE RHUMKORFF, OR INDUCTION COIL.

The Rhumkorff, or induction coil, is perhaps the most common type of x-ray machine in use today. Its principles of construction may be briefly described by stating that it consists of three essential parts, of which two are coils of wire, one contained within the other, although they have not electrical connection, and the third, an instrument known as an interrupter.

The inner coil, or primary as it is called, consists of a few turns of very coarse wire wrapped about a core of soft iron, which is known as the magnetic core. The outer coil or secondary, is made up of a great many turns of fine

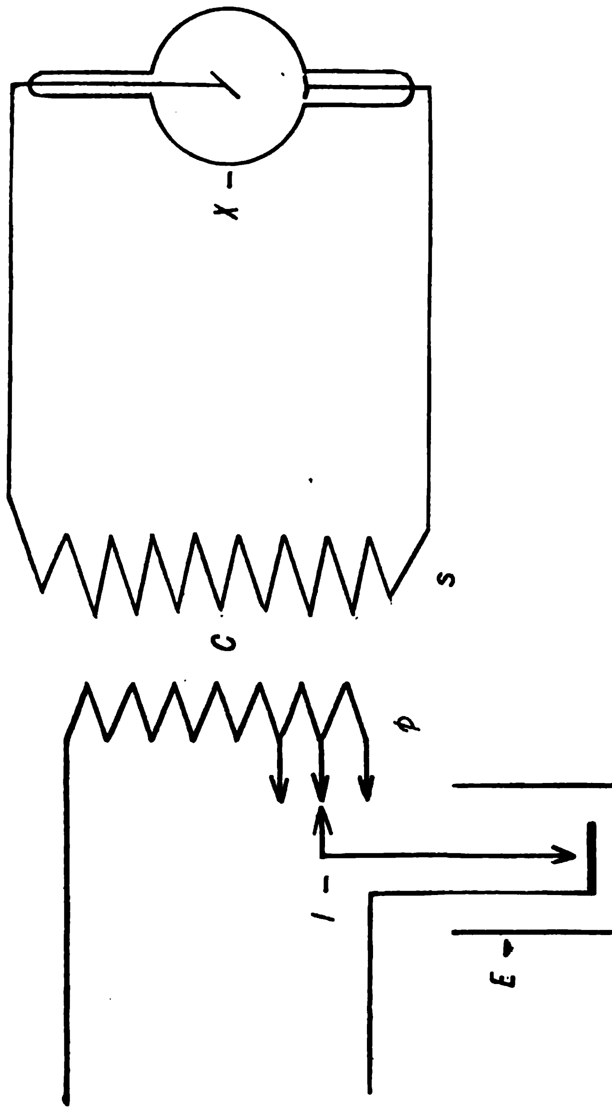


Fig. 2.—Diagram of the induction coil. *C*, induction coil; *P*, "the primary;" *S*, "the secondary;" *E*, electrolytic interrupter in circuit with the primary coil; *I*, rheostat and inductance control; *X*, x-ray tube connected to the terminals of the secondary coil.

insulated wire. The principles of construction of the induction are shown in Fig. 1.

The other requisite of the induction coil as mentioned, namely, the interrupter, is attached in circuit with the primary coil, and serves the purpose of rapidly interrupting the primary current which is necessary to produce and maintain the phenomenon of electro-magnetic induction. (See Fig. 2.)

The current which is taken from the x-ray machine and passed through the x-ray tube, comes from the terminals of the secondary coil, and is an induced current, produced by the magnetic field of the primary coil. As everyone is more or less familiar with the principles of electro-magnetic induction the writer will not discuss the subject to any extent. Suffice it to say here that the voltage of the transformed or induced current coming from the terminals of the secondary coil depends upon the ratio existing between the num-

ber of turns of wire in the primary and the number of turns of wire in the secondary.

If an induction coil is constructed with the same number of turns in the secondary as are present in the primary, the current induced in the secondary will be exactly equal to the current passed through the primary. The voltage will not be increased. On the other hand, if the secondary contains twice as many turns as the primary, the induced current will be double the voltage of the primary as each turn of the secondary induces a current in the turn directly adjacent to it, which must be added to the current induced in the first layer by the action of the primary current. Therefore, as we increase the number of turns in the secondary, we increase the E. M. F. or voltage.

It has been estimated that in a 12 inch induction coil, the secondary is

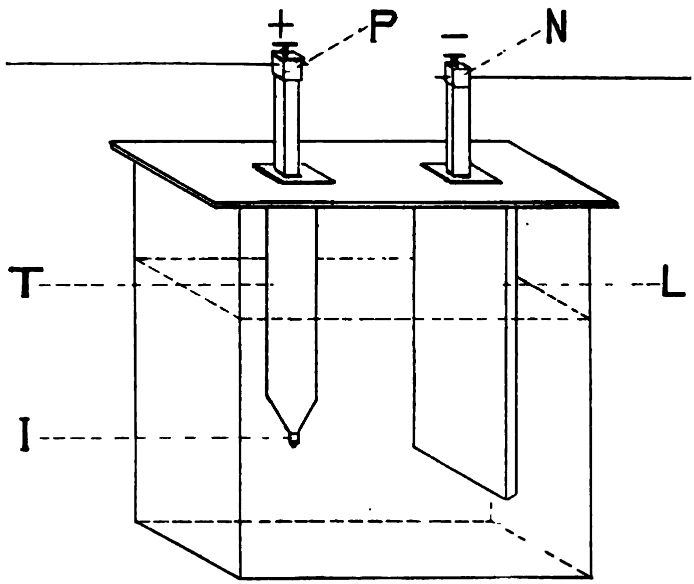


Fig. 3.—Diagram of the electrolytic interrupter. *P*, terminal of the positive electrode; *N*, terminal of the negative electrode; *T*, porcelain sheath or tube covering the positive electrode; *I*, platinum point of the positive electrode; *L*, negative electrode constructed of lead.

wound with between twenty and thirty miles of wire. This, of course, makes possible an enormous number of turns of wire, so that when we consider each turn of the secondary induces a current in the turn directly adjacent to it, which must be added to the current induced in the first layer by the action of the primary current, the sum total of the voltage of the current coming from the secondary amounts to something tremendous.

Another phenomenon not to be lost sight of, is that as the voltage or E. M. F. is increased, in the before described manner, the amperage or current strength is decreased in equal ratio. It will be seen, therefore, that the original current running to the primary is not changed in actual value but is simply transformed to a state or condition where it will do the special work required of it.

As stated previously, the phenomenon of electro-magnetic induction is

maintained by an instrument which rapidly interrupts, or in other words "makes" or "breaks" the primary current.

Two classes of these instruments are made, both of which utilize some automatic principle, and are known as "mechanical" and "electrolytic."

Mechanical interrupters, a simple illustration of which is the ordinary vibrator used on small coils, electric bells, etc., will rapidly make or break the primary current and thereby induce a fairly constant current in the secondary;

Fig. 4.—Induction coil, cabinet type.

but this form of interrupter has not been found to be as satisfactory for x-ray work as the electrolytic type.

Of the various forms of *electrolytic interrupters*, the Wennelt type is the most universally used. It consists of a large battery jar which is nearly filled with a solution composed of sulphuric acid, one part, and water, six parts. Into this solution are introduced two electrodes. The negative electrode is constructed of lead and has a large surface exposed, while the positive electrode is contained within a porcelain or hard rubber tube extending down into the solution with only the tip or end of the electrode exposed. The tip of

this electrode is usually made of platinum. Such an instrument is diagrammatically shown in Fig. 3.

The electrolytic interrupter is connected in the primary circuit and operates briefly as follows: As the current passes from the platinum point (the

Fig. 5.—Induction coil, cabinet type.

positive electrode) through the solution to the negative electrode, by virtue of its chemical action upon the solution, bubbles of gas are formed around the exposed platinum point. These bubbles act as a source of insulation and the current ceases to flow—*it is interrupted.* At the instant it is interrupted, the bubbles are dispersed, the solution again comes in contact with the electrode,

and the current is reestablished only to be broken again, and so on; these changes taking place with tremendous frequency. With such an instrument the primary current may be interrupted from 60 to 30,000 times per minute. These interrupters are sometimes constructed with several platinum points which makes possible a greater amperage in the current without decreasing the rate of interruptions. For dental radiography, however, a single point inter-

Fig. 6.—Induction coil with tube stand attached.

Fig. 7.—Induction coil of cabinet type.

rupter will usually suffice, and at most, not more than a two point interrupter need be used.

The interrupter, then, serves the purpose of creating the magnetic impulses which keep a constant current flowing from the secondary. We should bear in mind, however, that the currents produced by the "make" and "break" are not of equal strength, the current produced at the "break" having much the highest value. Due to the fact that this current is the strongest, and that the magnetic impulses come from the same direction (as the induction coil is used on the direct current) it prevails over the weaker. Therefore the induced or

secondary current which we use to energize the x-ray tube is the current which is created at the instant of the break.

The other wave, or that created by the "make," is current in the wrong direction, and is called "inverse current." In some induction coils this inverse current is the source of much trouble and where it is present to any appreciable extent, will result in blurred radiographs. It can be controlled, however, by the use of "valve tubes," or a "spark gap," arranged in series with the x-ray tube, the valve tube or spark gap serving the function of cutting out the weaker or

Fig. 8.—Induction coil constructed so that it may be attached to the wall.

inverse current, without interfering to any appreciable extent with the stronger current which is delivered to the terminals of the x-ray tube.

The induction coil is used on the direct current of 110 or 220 volts. Where only the alternating current is available, some means must be used to change the current from alternating to direct before it enters the primary circuit of the coil.

This change in the current can be accomplished by the use of a "rotary converter" of which several makes are available, or by a "chemical rectifier." These rectifiers generally consist of two electrodes immersed in a solution of

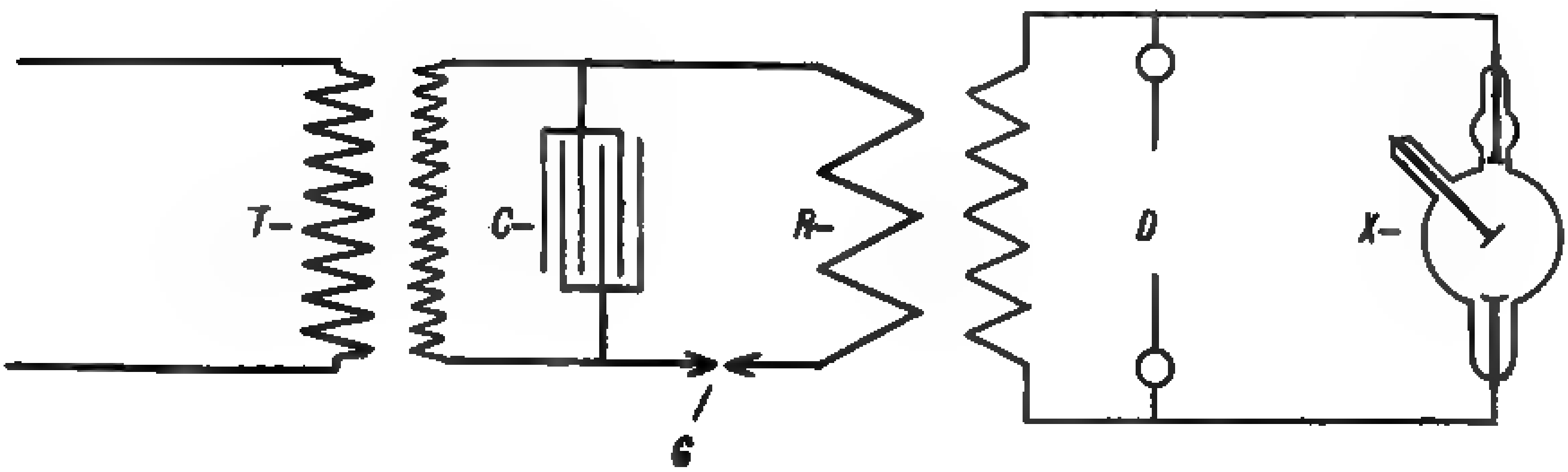


Fig. 9.—Diagram of the high frequency coil. *T*, alternating current transformer; *C*, condenser; *G*, spark gap; *R*, oscillation transformer; *D*, high tension discharge gap; *X*, high frequency x-ray tube.

Fig. 10.—Tesla coil of the portable type.

Fig. 11.—Tesla coil of the portable type.

the phosphate salts of potassium, sodium, or ammonium, one electrode being made of aluminum, and the other of lead, or carbon. When working properly, the current will flow to the aluminum through the solution, but not away from it, thus cutting out one wave of the alternating current, or it is possible, by properly connecting up three or four jars containing the electrodes, to utilize both waves of the current.

Induction coils are usually rated as to power by the maximum width of the secondary spark gap. That is, the amount of distance the spark will jump between the secondary terminals. For example, a 12-inch induction coil is capable of producing a spark which will jump twelve inches of atmosphere. While these coils are made in various sizes, capable of producing a spark from six

Fig. 12.—Tesla coil, adapted for attachment to the office wall.

Fig. 13.—Tesla coil, adapted for attachment to the office wall.

inches to forty inches in length, there is no particular advantage in using more than a 12-inch coil for dental radiography. Figs. 4, 5, 6, 7, and 8 show 12-inch induction coils constructed especially for the dental x-ray laboratory.

TESLA OR HIGH FREQUENCY COIL.

The Tesla, or high frequency, coil differs considerably in construction from the induction coil, although many of its principles are the same. In a way it is a double induction coil with the secondary of one coil acting as the primary of the other coil. An alternating current is utilized in the primary of the first coil and by means of the secondary of this same coil, is stepped up to a high voltage. This stepped up current is then carried to a condenser. As the current leaves the condenser it is oscillating at a great rate of frequency and passes into the primary of the Tesla or second coil where it induces a current in the

Fig. 14.—Tesla coil, cabinet type.

Fig. 15.—Tesla coil. Completely inclosed when not in use.

Fig. 16.—Tesla coil.

Fig. 17.—Tesla coil. Completely inclosed when not in use.

secondary of this coil. From the terminals of the last secondary, it is carried to the x-ray tube. The principles involved in this type of apparatus are shown in Fig. 9.

Like the current of the induction coil, the current from the Tesla coil is

Fig. 18. Tesla coil, cabinet type.

Fig. 19.—Tesla coil, mounted upon movable standard.

high in voltage and low in amperage, but, unlike the current from the induction coil, it is not unidirectional, but is alternating in character. For this reason, it is considered by some as being less desirable for radiographic purposes. However, this apparently objectionable feature is overcome by using an x-ray tube

constructed in such a way as to cut out one wave of the current and thereby produce practically the same result as where an unidirectional current is used.

These coils have the advantage of being less cumbersome, require less space, and are less expensive than the other forms of apparatus, but they cannot be depended upon to do the character of work which the powerful "induction coil" or "interrupterless transformer" will do. Notwithstanding this fact, this type of apparatus undoubtedly has a place in the x-ray laboratory of the dentist, and if constructed along proper lines, can render splendid service. Figs.

Fig. 20.—The working principles of the interrupterless transformer are here shown The synchronous motor used to operate the rectifying switch of the alternating current machine may also be used as a rotary converter where the direct current is desired for other purposes in the laboratory.

10 and 11 show Tesla coils of the portable type. Figs. 12, 13, 14, 15, 16, 17, 18 and 19 show Tesla coils which are larger and much more powerful than the portable type.

INTERRUPTERLESS TRANSFORMERS.

The interrupterless transformer is the newest and by all means the most powerful x-ray machine made. Aside from controlling and measuring apparatus, it consists of three principal parts, a rotary converter, if direct current is the source of supply, or a synchronous motor if the alternating current is the source of supply, a step-up transformer, and a rectifying switch.

Two types of these machines are made: viz., a direct current machine and an alternating current machine, the underlying principles of which are shown in Fig. 20.

Fig. 21.—Interrupterless transformer.

Fig. 22.—Interrupterless transformer.

Fig. 23.—Interrupterless transformer.

When used on the direct current, the rotary converter is set in motion and generates an alternating current which is sent through the primary of the step-up transformer. This induces a current in the secondary of the proper voltage, but alternating in character. The rectifying switch then changes this cur-

Fig. 24.—Interrupterless transformer

rent from an alternating to a direct current and as such it is delivered to the terminals of the tube.

The alternating current machine differs only from the direct current machine in that the alternating current is run directly into the primary of the step-up transformer. This induces a current in the secondary of the proper

voltage but alternating in character. The rectifying switch then changes this high voltage alternating current to a direct current, and as such it is carried to the terminals of the tube.

The interrupterless transformer is, as stated before, the most powerful and efficient type of apparatus available for x-ray work. It is likewise the most expensive,—perhaps too expensive to be considered for the x-ray laboratory of the average practitioner of dentistry, in view of the fact that with the induction coil and other less expensive apparatus such excellent results can be

Fig. 25.—Interrupterless transformer.

obtained. Figs. 21, 22, 23, 24, 25, 26 and 27 show interrupterless transformers constructed especially for the dental x-ray laboratory.

The preceding remark, however, should not be construed as an argument against the interrupterless transformer. To the prospective purchaser who desires the very best, regardless of expense, or who expects to do a great deal of radiography, the initial expense should not be the prime consideration, as oftentimes the most expensive things in the long run prove a matter of economy.

In conclusion, I would emphasize the fact that the character of the radiography which any physician or dentist is able to do, does not depend entirely upon the excellence of his laboratory equipment. Instances could easily be

Figs. 26 and 27.—Type of interrupterless transformer.

cited where the best of equipment fails to produce the highest type of results, and vice versa, where unpretentious equipment in some hands has proved more than satisfactory. After all, the comparative degree of efficiency of the various types of x-ray machines must depend largely upon the judgment and skill of those who operate them.

The International Journal of Orthodontia

PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 801-807 Metropolitan Bldg., St. Louis, Mo.

Foreign Depots—*Great Britain*—Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

Subscription Rates—Single Copies, 30 cents. To anywhere in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $3.00 per year in advance. Under foreign postage, $3.40. English price: 15/ per annum, 1/6 per number. Volume begins with January and ends with December of each year.

Remittances—Remittances for subscriptions should be made by check, draft, postoffice or express money order, or registered letter, payable to the publishers, The C. V. Mosby Company.

Contributions—The editor will be pleased to consider the publication of original communications of merit on orthodontic and allied subjects, which must be contributed solely to this journal.

Opinions—Neither the editor nor the publisher hold themselves responsible for the opinions of contributors, nor are they responsible for other than editorial statements.

Reprints—Since it is not desirable to hold type standing longer than absolutely necessary, all requests for reprints should be made at time of submitting manuscript for publication. Rate card will be sent with galley proof.

Communications—Contributed articles, illustrations, letters, books for review, and all other matter pertaining to the editorial department should be addressed to the Editor, Doctor Martin Dewey, 1016 East Armour Boulevard, Kansas City, Mo. All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 801-807 Metropolitan Building, St. Louis, Mo.

Illustrations—Such halftones and zinc etchings as in the judgment of the editor are necessary to illustrate articles will be furnished when photographs or drawings are supplied by the authors of said articles.

Advertisements—Objectionable advertisements will not be accepted for publication in this journal. Forms close first of month preceding date of issue. Advertising rates and sizes on application.

Change of Address—The publishers should be advised of change of subscriber's address about fifteen days before date of issue, with both new and old addresses given.

Nonreceipt of Copies—Complaints for nonreceipt of copies or requests for extra numbers must be received on or before the fifteenth of the month of publication; otherwise the supply is apt to be exhausted.

Entered at the Post Office at St. Louis, Mo., as Second-Class Matter

EDITORIALS

Is Radiography a Trade or a Profession?

ALTHOUGH radiography was discovered over twenty years ago and has been used in dentistry for several years, it did not gain popularity as a diagnostic agent until the relation between alveolar abscesses and systemic disorders were so widely heralded. Not until the relations between infected teeth and constitutional diseases were proved did the dental profession take advantage of the aid which the radiograph offered to them.

With the adoption of the radiograph by the dental profession as a diagnostic agent, we find many things have occurred which are not exactly as they should be. With the medical profession claiming that devitalized teeth are sources of systemic infection, we find that a number of dentists have accepted that verdict without a question of a doubt and have based their diagnosis entirely upon the radiograph. This diagnosis is often based on the reading of the radiograph by one not properly versed in the interpretation of radiographs. Very often the diagnosis is made without any clinical knowledge of the case.

A radiograph is valuable only as it becomes an aid in conjunction with other means of diagnosis. We have known of teeth being diagnosed by the radiograph as "dead teeth" when every other known means of diagnosis showed them to be "alive." This was not the fault of the radiograph, but was the fault of someone trying to read into the radiograph what they could not see, and the disregard for other clinical symptoms. As a result of this, dental radiography is in a rather peculiar position. Some members of the dental profession have turned against it believing that it has no diagnostic value; others have acknowledged their inability to read a film; while still others are confident that they can properly read any film after having seen one or two radiographs. This is an unfortunate circumstance, but, no doubt, the men who say they cannot interpret a film know more about radiography than those who can read and diagnose any case from any kind of a picture. Those who acknowledge their inability to diagnose every condition from the radiograph are the least dangerous to the public—they realize that radiography is a profession and a specialty of dentistry and can only be properly learned by a long course of professional training, and that radiography is not a "photographic side line" that can be of value to a profession if practiced as such.

The impression seems to have got abroad that the only requisites necessary to become a dental radiographer are sufficient capital to purchase an outfit and the courage to fool with something one knows little about, or the dangers thereof, and the disposition to enter a profession of which one knows little. Unfortunately, there is no law governing the practice of dental radiography in most states. In a few states it might be possible to so construe the law to govern that branch of dentistry, but it would also be possible in most states to construe the law to permit the practice of dental radiography by men who possess no dental or medical training. We find this has actually happened in some states. As a result of the acceptance of the value of the radiograph by the dental profession, many laymen have been attracted by the commercial possibilities of radiography, with the result that men who have no knowledge of dentistry whatsoever have established offices for the taking of dental radiographs. Commercial photographers, electricians, and window trimmers have developed overnight into dental radiographers, some of them not even knowing how many teeth there are in the oral cavity, besides the many other things a dental radiographer should know. Men totally unqualified as dentists or physicians have opened offices in different sections of the country and are making thousands of radiographs daily, a great many of which are beautiful pictures from a photographic standpoint, but most of which are of little value to the patient as an aid in diagnosis, for the radiographer does not know anything about the clinical history of the case and the dentist for whom the radiograph was made has not had enough experience to properly read the film. The dentist does not know the conditions under which the radiograph was taken, the position of the tube, the time of exposure or the technic of developing the plate.

We have mentioned the fact that many men are becoming dental radiographers without any dental or medical training. This is unfortunate; but it is more unfortunate that the dentists should so little respect their profession that

they would be willing to turn their patients to a man to assist them in diagnosing their case, who is not a professional man. If a physician desires to have assistance in the diagnosis of a case, he calls in a man who is a physician, or has had some training along medical lines. If a dentist desires aid in diagnosing a condition, he should respect his profession enough to enlist the aid of a professional man. Still we find dentists who are daily consulting with men who have no dental knowledge and seeking their advice in the diagnosis and treatment of pathological conditions. It takes several years of study to become a dentist, one must possess certain requirements to satisfy the law, but, to become a dental radiographer, one needs only to advertise to the dental profession that he will take radiographs for so much "per," and a large number of the profession are willing to receive him with open arms and consult with a man who knows nothing of anatomy, or pathology, and who has become a dental radiographer because he believes the commercial possibilities are greater than being an electrician, photographer, or window trimmer. These men who have entered dental radiography have no knowledge of professional ethics and use all sorts of means to advertise themselves before the public. Recently, we saw a number of lantern slides, shown by a professional man, that had been made by a commercial (we will not call him a dental radiographer, for we have too much respect for the profession) radiographer, who had placed his name in the slide in such a position that it was the most prominent part of the picture. He recognized the value of advertising, but has chosen a means that we cannot sanction—all because his education was neglected along the proper lines. As the conditions are at present, the dental profession has lowered itself by being willing to allow a class of men, who have no professional knowledge whatever, to diagnose their cases.

Again, dental radiography is only in its infancy and must be advanced along scientific lines to be of any professional value. Men who are only interested in radiography for what they can get out of it will not advance it scientifically.

Also, a patient consults a dentist because the patient knows the dentist must have certain qualifications. The patient wants the services of one educated in the dental profession. Still, the dentist will often betray the confidence of the patient by referring him to a commercial radiographer who knows nothing about pathology, and who has no professional education. It is not fair to the patient. Also, commercial radiographers, knowing nothing about pathology and infectious diseases, are not able to protect the patient as they should. We have even known commercial radiographers to work a half day and not even wash their hands. In taking films intraorally, it is always necessary to at least approach the mouth even if you do not place your fingers in the mouth. If they allow the patients to place the films themselves, occasionally the result will be satisfactory. The possibility of infecting one patient from another by men who have no knowledge of sanitary and antiseptic methods becomes apparent and is no idle dream.

We have already mentioned the fact that many faulty diagnoses have been made by commercial radiographers, and if this continues, the public will lose

faith in radiography, as some are doing already, and dentistry will have to suffer therefrom. The dental profession should be more careful in referring patients to men who have no professional training, than they have been in the past.

Some have suggested that there should be laws made to regulate the practice of radiography. This is not necessary because patients are referred to radiographers and the commercial radiographer will exist only when the dental profession supports him. If dentists are unwilling to consult with men who are inferior to them in professional training, the commercial radiographer will be forced back into the trade from which he came and dentistry will have eliminated one objectionable factor that promises to become as dangerous as the dental parlors.

Dental radiography is a profession and not a trade and should be practiced by professional men.

The Appliance Joker

IN the evolution of medical science the day is not so far remote when it was religiously believed that the skin of a black cat, which was killed during the dark of the moon, applied to the human anatomy would quickly remedy almost any complaint which human beings might be heir to. Fortunately, however, time, experience and education have proved the fallacy of all superstition in medicine.

If we are to judge from the character of advertising which proposes to point out the merits of some of our so-called modern orthodontic appliances, we are not as yet beyond the black cat stage in the development of orthodontia as a science. The dental profession is being bombarded with literature and illustrations of orthodontic appliances of the "cure while you wait, work while you sleep" variety which smacks of the patent medicine tactics of yore. It is unique, even from a commercial standpoint, indeed that after men have spent their lives developing basic principles of a science which have been universally accepted by the best informed minds of the world on subjects orthodontic, that advertising should appear pointing out principles directly antagonistic to the generally accepted scientific basic principles of a science.

Manufacturers of orthodontic appliances must keep pace with the advancement of the profession if they expect to retain the respect of the profession for their goods. To advertise principles of treatment and methods which passed on in a former epoch of history can only appear ludicrous to those informed upon the subject or appear to be another case of "the blind leaders of the blind," which latter policy will not endure the test of time, and for which there can be no legitimate excuse in the present day when all information is available.

There is no place in modern orthodontia for appliances which will move teeth over night or for those which pretend to get results automatically with a spectacular flourish. What we do want are mechanical means which are efficient and effective and which work in accordance with Nature's physiological laws. Neither has there ever been an appliance which does not require the

closest application to detail and painstaking care in order to insure the results which we are after.

To advertise a surgeon's knife which would do an appendectomy in the hand of an inexperienced child would deserve no more ridicule than that which is due to an orthodontic appliance for which most remarkable claims are being made. Let us have progress and the goods of merit will not require spectacular advertising to make themselves of service to those who require orthodontic equipment.

Pacific Coast Society of Orthodontists

THE fourth annual meeting of the Pacific Coast Society of Orthodontists was held at the Palace Hotel in San Francisco on the twelfth and thirteenth of February. The following program was presented:

Monday, February 12.—President's Address by Dr. James D. McCoy, of Los Angeles; "Recent Developments in Orthodontic Technic," by Dr. A. H. Ketcham, of Denver; "The Possibilities of Systemic Complications During Orthodontic Procedures," by Dr. Julio Endelman, of Los Angeles.

Tuesday, February 13.—"Some Suggestions as to Prophylactic Measures for the Orthodontist," by Dr. D. Arthur Johnston, of Los Angeles; "Artificial Restoration of Missing Teeth Following Orthodontic Procedure," by Dr. C. J. R. Engstrom, of Los Angeles; "A Study of Some Dental Anomalies," by Dr. B. Frank Gray, of Colorado Springs. The following Clinics were given: "The Ribbon Arch and Bracket Attachment," by Dr. A. H. Ketcham, of Denver; "The .0225 Alignment Wire," by Dr. Allen Suggett, of San Francisco; "A Simple and Efficient Attachment for the Bite Plate," by Dr. John R. McCoy, of Los Angeles; "Case Report," by Dr. Robert Dunn, of San Francisco; "Combination Attachment," by Dr. A. A. Solley, of San Francisco; "A Lingual Appliance for the Expansion of Deciduous Arches," by Dr. James D. McCoy, of Los Angeles.

Regarding News Items

THE editors of the Journal will be pleased to receive from the members of the profession short news items, change of addresses, "practical pointers," descriptions of new appliances, or any other news that will be of interest to orthodontists, for publication in the columns of this Journal. All such correspondence should be conducted with the publishers and should be addressed to our St. Louis office in the Metropolitan Building.

The International Journal of Orthodontia

Editor: Martin Dewey, D.D.S., M.D.

VOL. III — ST. LOUIS, MARCH, 1917 — NO. 3

ORIGINAL ARTICLES

SOME SUGGESTIONS AS TO PROPHYLACTIC MEASURES FOR THE ORTHODONTIST*

BY D. ARTHUR JOHNSTON, D.D.S., LOS ANGELES, CALIF.

THE orthodontist is in a position to know how much prophylaxis is neglected with children, his patients coming from a class who wish to have the best service possible.

After consulting several orthodontists on this subject, I believe I am safe in making the statement that only a small percentage are having prophylactic treatment at regular periods, or when necessary.

It is a known fact that orthodontic appliances are often placed on teeth that are in no condition to receive them.

Enamel that is rough and stained, also superficial defects, should be polished according to modern prophylactic methods. All cavities should be filled, septic teeth removed or treated, and the mouth put in a healthy condition before any appliances are placed. Deep pits and grooves of the erupting teeth should be protected by flowing oxyphosphate cement over them as soon as they are accessible. This should be done before there is any possible chance for even an etched condition of the surface. This operation should be repeated when necessary until the teeth are in occlusion, and the patient is able to take care of them.

After the appliances are in place, it is necessary to give monthly prophylactic treatment, to care for the areas especially liable to decay, such as the approximal surfaces against bands and ligatures.

With some of the new appliances, ligatures are practically eliminated. This is an important factor.

After the appliances are removed, and before the case is dismissed, the teeth should again be carefully gone over. The etched enamel caused by wire ligatures and loose bands and superficial decay should have preventive treatment.

*Read before the Pacific Coast Society of Orthodontists, Feb. 12, 1917.

We all appreciate the importance of this work, about which there has been so much said, so many articles written in the past ten years, and so little accomplished.

If it is impossible to have the cooperation of the dentist who refers the patient, to do the prophylactic work, I suggest that the orthodontist or his assistant take care of these cases.

The following is a modified technic for the orthodontist:

One of the first steps is the removal of loose matter from between the teeth with the floss silk. Care must be taken to remove all deposits underneath the free margin of the gums.

Roughened enamel and superficial decay is made smooth with fine carborundum and Arkansas stones, following up with fine garnet disks about No. 6-0 and fine cuttle fish, using vaseline on the disks and water on the stones.

Sensitive spots and superficial decay may be touched up with silver nitrate saturated solution. I have had the best results by drying the surfaces and rubbing in the solution with the wood points.

If there are any synthetic or porcelain fillings, they should be protected with wax.

The disclosing solution, the formula of which is iodine crystals, 50 gr.; potassium iodide, 15 gr.; zinc iodide, 15 gr.; glycerine, 4 dr.; aqua distillate, 4 dr., is applied to the crowns of the teeth and will show up the plaques, if any are left after treatment. This solution is also good for inflamed gum tissue.

The next step consists in the use of the dental tape run through moistened (Dr. D. D. Smith's) flour of pumice which is carried to the approximal surfaces of the teeth. If any point between the teeth is inaccessible, the teeth should be wedged apart. The mouth should be washed out with warm water from a syringe, and the entire oral cavity sprayed, as this leaves a freshness which patients appreciate. With children it is a good plan to use a mouth wash that is pleasant to the taste.

It is extremely necessary that patients be instructed in regard to home treatment and the proper way to use the brush. Every patient should have a water syringe (S. S. White & Company's Chip Syringe No. 27 S), and the nurse or mother be shown how to use it in irrigating around the appliances when the toilet of the mouth is made, before retiring at night.

MOUTH WASHES, PASTES, AND POWDERS.

The late Dr. G. V. Black says (in substance) when the gingivæ are sore and inflamed, after removing the local cause, physiological salt solution should be used in the syringe instead of plain water until the soreness is passed. This should be done in a thorough manner. (No antiseptics of any kind should be used.) Dr. Black believed that mouth washes, pastes, and powders were of very little or no value. If there is no diseased tissue, they are not indicated. If there is any merit in antiseptic mouth washes, their effect is but of a few minutes' duration.

Some children, and possibly many adults, may be induced to take better care of their mouths if a pleasant tasting mouth wash or powder or paste is prescribed. The most of these preparations are harmless, although some are injurious.

DIET.

If you have the cooperation of the parents, some good results may be obtained by the diet of your patients. There can be no dispute over the fact that most of our dental disorders are affected by what we eat and how we eat it. The carbohydrate diet, such as pastry, fresh bread, syrups, and the washing down of food with liquids, is no doubt injurious to the teeth.

Nature fails to support anything that is unnecessary, and people who live on such a diet do not need teeth and will not have them long.

The teeth must have vigorous use and the oral tissues a certain amount of massage in order to maintain health.

The action of hard foods in chewing is nature's way of cleaning and polishing the teeth and massaging the gums. In this way a normal flow of saliva is produced, and performs its proper function.

Pickerill and others have stated that a carefully selected diet will help to make the mouth self-cleansing. Dr. J. Sim Wallace, in his work on "The Prevention of Dental Caries" says: "The diet should contain a sufficiency of solid food of a consistence which will insure a thorough cleansing of the teeth by the food, and stimulate the pleasurable activity of efficient mastication so as to prevent the child acquiring the habit of bolting it's food." He believes the meal should not terminate with concentrated and easily fermentable carbohydrates which lodge or stick about the teeth. If these things are eaten, they must be followed with fresh fruit that will clean the mouth. Of all fruits for this purpose apples are the best.

The time will come when public health boards will demand cleanliness in the selection and serving of foods, and foods that contribute to the health and strength of the nation will have the preference.

No medical treatment, systemic or local, has been discovered as a universal remedy for the removal of oral accumulations or for the cure of mouth diseases.

The surgical removal only of deposits, and the polishing, brushing, and massage by the dentist at stated intervals, and by the patients daily, are the only practical methods.

The necessity of the cleaning of the teeth was practiced by the Egyptians three thousand years before Christ as an aid to beauty and as a prophylactic measure.

The ancient Hindus, Chinese, Greeks, and Romans knew the value of mouth hygiene. To them a clean mouth was an indication of culture and health as it is today.

In conclusion, I feel that orthodontia as well as the specialty of dentistry I represent, deals essentially with prophylaxis. With you the thing of foremost importance in dealing with young children is to prevent malocclusion of the teeth—believing that prevention is so much better than cure, likewise in the course of your treatment of dental irregularities, you desire to prevent dental caries, and mouth infection. In this latter, the interest of the specialist in prophylaxis and the orthodontist is almost identical. I trust our work directed to a common end as suggested, shall become increasingly interesting as time goes on.

DISCUSSION.

Dr. Engstrom.—Mr. President and members, I wish to thank Dr. Johnston for his splendid paper. I think we have all enjoyed it very much. The question of prophylaxis is of great interest to the orthodontists. The presentation of this paper by Dr. Johnston, as well as other papers by members of the profession, I think is perfectly proper, and our discussion of these questions together should be of mutual advantage to the different specialties of dentistry represented; and conditions with which each has to deal will be better understood.

In orthodontic treatment, no doubt, we interfere with normal function, and that has a great deal to do with the uncleanly condition of the mouth and the difficulty of keeping it in a hygienic condition. It is not always the fault of the operator. I lay more stress upon the interference with proper function of the tissues. Consequently, we have to resort to artificial means to overcome this defect. As Dr. Dunn has stated, he has noticed that the inflammation of gum tissue during treatment has readily subsided after the removal of appliances, showing, I think, interference with normal function, and restoration to normal function; i.e., restoration after the natural cleansing of the teeth has been resumed. I leave the rest of the discussion to the members.

Dr. Cavanagh.—I think our papers this afternoon are following very logically and in their natural sequence. Our work, as I mentioned before, is very largely referred work, and in our treatment we should remember there is another specialty in dentistry—that of prophylaxis. To what extent are we entitled to follow prophylactic treatment without intruding on the field of those who practice prophylaxis? Is it wise to have in our own offices some one who is practicing this work exclusively? That is an admirable arrangement, but we must expect where we have some one doing that work in our offices, the specialists in prophylaxis are not going to be very ready to recommend patients to us. Should we therefore just do our own work and refer patients back to the prophylaxis expert for the care they very often need? Also, to what extent are we to undertake prophylactic work when the patients are under our care, when they are sent to us from offices who engage assistants whose duty it is to take care of patients in this manner? There is an ethical question which must be considered.

Dr. Solley.—A question has occurred to me as to prophylaxis. I think many times a great amount of care due our patients is necessitated through the complexity of our appliances, as we are going on now from day to day. That is one side of our work needing attention. Rather than simplicity, our appliances seem to be running into complexity more and more. If we could turn around and take stock of ourselves, and see wherein the best possible appliances properly adapted to each individual case, could be used, I think we would do well. I feel we are running away with ourselves in this matter of appliances and doing our patients great harm from a prophylactic standpoint in many instances.

Dr. Dunn.—I think Dr. Johnston's suggestions as to the thorough cleaning and polishing of the teeth before we proceed with our operations, or the placing of appliances, are splendid, i. e., that we either do this work in our own offices or see that it is done by the man who refers the case to us. Then, during the period of our treatment, we are to give our personal attention to this work, and at the time we change our appliances, if we have special prophylactic attention given the patient by an expert, I think we would cover the field very thoroughly. That has been my experience in one or two cases in connection with a prophylaxis specialist in the city, and I have found with children especially indifferent to the care of the teeth, that the results have been most gratifying, indeed. The teeth were thoroughly gone over by this specialist. All the surfaces were thoroughly polished and kept in good condition in our own office, and when the regulating appliances were removed and the case was ready for retention, the patient was referred back for prophylactic attention with especially good results. This plan also stimulated in these children the greater desire to keep the teeth clean, after they had been to this oral prophylaxis man. They concluded it was easier to keep the teeth clean themselves than to have this course of treatment. Not that it was severe, but they did not seem to like to spend the necessary time to have their teeth cleaned.

Dr. Hampton.—Mr. President and members of the Society: Prophylaxis has been a hobby of mine for twenty-five years and it has been a problem that I have tried to solve. I have been all over the country and have studied the matter. While in a city I was with a man who makes a specialty of that, and he is able to take care of the children's work remarkably rapidly I think. He has a specialist in his office. I asked the Board there if it

would be possible to get a dental nurse. They said in that state it was not. She could not go into an office and practice prophylaxis without being a graduate and having a certificate from the Board. I brought it up before our Board in Montana, of which I am a member. They stated they would like to allow it but did not think it right as it would open the gate for others. So you cannot get a trained nurse for the office unless you get one with a certificate from the State Board, and who is especially fitted for that work. In the city it seems to me you orthodontists could send patients to a specialist in prophylaxis, or have a nurse who has taken a special course in your office to take care of your patients while wearing the appliances, and after that period they can be referred to the specialist.

I think prophylaxis is one of the greatest things we have before us.

Now Dr. Endelman has spoken of the bands,—never having seen a healthy gingiva around bands. They are very scarce. I think I have seen possibly seven per cent around gold crowns. I do not say they are all bad, but I do know that with a proper fitting band and crown, and with proper prophylaxis, one can maintain very much better conditions than without prophylaxis. So we have to combine them all, as I do in a small community. However, it seems to me, whether the patients are referred to a prophylaxis man or not, it would be better to attend to them in the office, and when they leave, refer them to a prophylaxis expert.

Dr. Dunn.—If we interpret our law as it reads, it would not permit an assistant in the office to touch a tooth in any way. Thus we are all violating this law every day. I am violating the law every day, I am sure. To my belief, the law should be amended. I would like to see any man who is doing the right thing by his patients, who is not violating the law.

Dr. Hampton.—Then it is our duty to get different laws. It is as they said to me,—if you permit one then you have to permit others.

Dr. Dunn.—Then we must amend our laws. There are a great many laws that are violated in all walks of life: for instance, the speed laws with reference to automobiles. This care of the teeth in orthodontic practice is a serious thing. The children must be given attention every time they come in the office, whether they are careful or not. Can we employ a person to whom we pay $150 or $200 a month to do that work? How many of us can do it?

Dr. McCoy.—I think Dr. Hampton is correct in his interpretation of the law, but I believe where we may not be able to carry on oral prophylaxis in our offices under ideal circumstances, the nurse can be employed if done diplomatically, with larger benefits to our patients. They could not perform the real prophylaxis such as Dr. Johnston and others are doing, and such as we would have done prior to beginning treatment and perhaps before the retainers go on, as Dr. Dunn suggests; but the monthly or bimonthly cleanings could be done by the nurse under the orthodontist's direction as the orthodontist could show the parent how to brush the child's teeth, for instance. If diplomatically done, I think nobody would be given any trouble.

Dr. Dunn.—According to the letter of the law, a mother really could not take a tooth brush and brush a child's teeth.

Dr. Cavanagh.—In Portland they tried to prosecute a man for allowing his assistant to polish and clean the teeth of his patients. The court made the statement that it was all folly,—that if he had the right to brush his own teeth he had an equal right to let any one else do it. If I can brush my teeth myself, and if I trust you (whether you have a diploma or not) to brush my teeth, have I not the right to allow you to do it? That was the legal view of it and the case was dismissed.

Dr. Hampton.—I would like to have an assistant in my office, and agree with you, but according to the law, those men using nonlicensed men in their offices are subject to prosecution just as the nonlicensed men are themselves.

Dr. Solley.—I think one point I made has been overlooked, that is, the matter of the nurse; what I wanted to bring out was to legalize your dental nurse. There would have to be in our colleges probably a year's course just for that sort of work, and legalize her to do it. I think gradually that is the way the thing is going to work out.

Dr. Hampton.—The only trouble is that with you it is all right, but there is a man across the street who is not so conscientious, and with him it may not be all right.

Dr. Ketcham.—You are familiar with the Fones School for the training of dental hygienists or nurses to do cleaning of the teeth of children in public schools in Connecticut,

and which also trains dental assistants. The law has been so amended that it permits these dental nurses to do this prophylactic work. It seems to me the law can be very plainly read, "prophylaxis or the cleaning of teeth," and be so written or interpreted that it would not include other work.

Dr. Cavanagh.—Then Dr. Ketcham would have to be able to differentiate between prophylaxis without a diseased condition, and the treatment of disease with prophylaxis when it involved the loss of the peridental membrane and the absorption of the alveolar process. There is no way to draw the line. The treatment naturally is a very intricate operation, requiring intimate knowledge of the investing membranes of the teeth, and anatomy, and histology. There is no place to stop.

Dr. Ketcham.—Stop with the children.

Dr. Cavanagh.—I have seen children with fairly well developed cases of pyorrhea at six and seven years of age.

Dr. Engstrom.—It appears to me we have to do prophylactic work ourselves, or have a nurse do it in our offices. Undoubtedly the means given to us in the paper is quite efficient for ordinary cases; and if properly followed out by the patients, would keep the mouth in very good condition. The thought expressed by Dr. Solley of the patient not being able financially to pay for the services of the prophylactic specialist, is interesting. I feel that telling them they will be referred to the specialist in prophylaxis will, in itself, be an incentive to the child to keep the mouth in a proper condition.

Dr. Johnston.—Who shall do this prophylactic work is an important question. There is so much of it to do I think it will not be long until the general practitioner who is trying to do everything according to the most approved methods, will have somebody in the office to do this work. Whether it will be a dental nurse, properly trained in the schools, or whether some other method will be worked out, is still to be determined.

If the dentists referring the patient to the orthodontist, would only put in an hour or two on that case, grinding and polishing the teeth and taking care of the few areas needing special attention, it seems to me after the appliances are in place, your assistant would be able to polish and give the regular prophylactic treatment, say once a month. It would require fifteen or twenty minutes' time, but you could add a charge for this time to the fee you make the patient. Certainly it is just as necessary to take care of the patient in this regard as in any other, and when your work is completed, if the teeth are not in good condition, the families whom you serve will be willing to pay for the few hours of prophylactic work that is required.

Like root canal work, if too busy to do it, we must demand better compensation for our time so that we may find the work worth while.

In regard to pyorrhea in patients of six or seven years of age, I have never seen a case of pyorrhea at that age, but I saw a case at the College a year or two ago in a boy of fifteen years of age who had lost most of his teeth. Dr. Hartzell showed a case on the screen at the Panama Pacific Dental Congress of a girl twelve years, I think, who had lost all her teeth from pyorrhea. No reason could be given for it. No doubt there had been cases of inflamed gum tissue where the teeth are lost.

I thank those who have so kindly discussed the paper.

A QUICKLY ADJUSTABLE FRACTURE BAND AND ITS POSSIBILITIES IN WAR DENTAL SURGERY

By Herbert A. Pullen, D.M.D., Buffalo, N. Y.

IN reviewing the emergencies of war dental surgery as presented to us in the hospital work of the dentists in the European Ambulance Hospitals, it has occurred to the writer that the operations in many of the cases of jaw restoration were unavoidably delayed for many days and some for several weeks before they fell into the able hands of the dental surgeons of the various hospitals for treatment.

This delay, because of the necessarily slow transportation to certain base hospitals situated some distance from the front, and also because of the necessity of first treating more serious injuries of the wounded soldiers, allows of a certain amount of healing of the tissues in abnormal approximation as in the cases of fractured jaws with displaced sections.

Fig. 1.

These abnormal attachments have to be forcibly broken up, and the displaced sections of the fractured jaws replaced in their normal relations by heroic methods or by the slower movement of the jackscrew.

Fig. 2

While understanding perfectly the necessity for these delays, it has seemed to the writer that if some of these cases could receive early temporary attention in the way of a hasty restoration of the sections of a fractured jaw by means of a simple and quickly adjusted apparatus, much of the later heroic restorations would be avoided and much less suffering would ensue.

What is apparently needed is a quickly and easily adjustable fracture band, adaptable to any of the teeth in the upper or lower arch, and to which suitable ligation may be made to temporarily retain the displaced sections of a fracture

so that the healing process may begin as early as possible after the wound has been received, provided the possibilities of sepsis are also taken care of.

Wiring of the teeth without the use of fracture bands, while effectual in some cases, is not as direct and positive as is the use of fracture bands applied to firm teeth situated a little distance from the line of fracture.

Granted, then, that the tightly adjustable band is preferable to the plain wiring of the teeth in these cases, the writer wishes to present a new form of

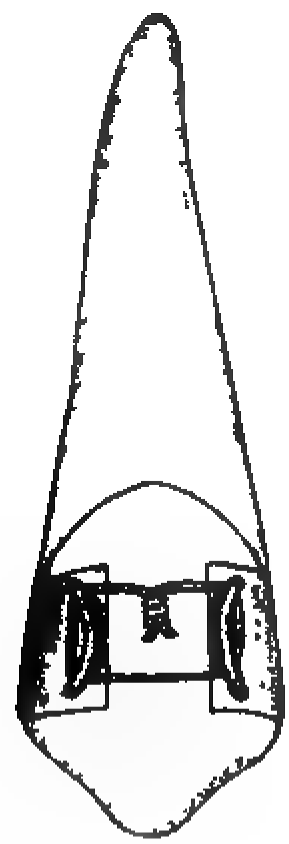


Fig. 3.

adjustable fracture band, (Fig. 1) which is more quickly adjusted than the fracture clamp band, not requiring a wrench for its adjustment, but the simple twisting of a heavy silver or brass wire around the curved horns on either end of the band.

It consists of a German silver band (Fig. 2) which has soldered across each end a short curved section of heavy German silver wire, which, by reason

Fig. 4.

of the projecting horns thus formed, is readily ligated on the labial or buccal surface of a tooth, being thus quickly adjusted and adapted.

A further advantage in its application lies in the fact that the band automatically conforms to the narrow neck of a tooth by the twisting of the labial ligature, as shown in Fig. 3, as the force is exerted in parallel lines across the horns, and continues to tighten the gingival edge of the band after it has already

become tight at the coronal edge, thus giving it additional support, and preventing the band from slipping off under a strain from ligatures attached from it to teeth in the opposite jaw.

By reason of its being quickly adjusted to the teeth, the use of this form of band might be of service in field and base hospitals in war time, in cases of gunshot fractures of the mandible or maxilla. Bands of this form on opposite sides of the mouth may also be quickly joined together by a section of a heavy wire solder (soft solder) as shown in Fig. 4, and the two halves of the mandible held in their proper positions in cases where the front section of the mandible has been shot away.

The wire solder may be quickly and forcibly bent with the fingers to any desired width so as to accommodate displaced fragments of a fracture, and yet will have enough stability to preserve its shape under considerable stress. A number of attachments of the wire solder may be made to individual bands upon several teeth in the arch to give added support.

Also a smooth rounded section of metal may be attached anteriorly to the wire solder to form a smooth surface for the work of the plastic surgeon in reforming the lower lip over this form.

If the teeth selected for banding in a fractured jaw are very tight together, it is an easy matter to separate them overnight sufficiently to secure plenty of space between the teeth for bands to be slipped on selected teeth by using the method of the orthodontist in separating teeth in the placing of silk or wire ligatures in the interproximate spaces on each side of the tooth to be banded.

Many other combinations in the use of this quickly adjustable band will suggest themselves to the dental surgeon in field or base hospital service where, especially, the quick fixation of fractures and the starting of the healing processes with the fractured portions in their normal relations precludes the necessity of the later breaking up of cicatricial tissues formed by the delay in treatment and the consequent displacement of fragments of the fractured bone. The injured jaws, being thus more quickly healed in their normal relations, the patient is very much more comfortable and the results of facial deformity are averted to a considerable degree.

MULTI-VIEW-ORTHO-PHOTOGRAPHY

By Rudolph L. Hanau,
Consulting Dental Engineer, New York City.

DURING the discussion of my paper before the 1916 meeting of the American Society of Orthodontists in Pittsburgh, the possibility of making multi-view photographs by means of reflecting mirrors suggested itself.

During the last twelve months of my practice, in aligning engineering with practical orthodontia, I have used the camera to a great extent. In the preparation of the paper for the Pittsburgh meeting, which, I regret, has not yet reached its turn for publication in the Society's organ, I made photographs of models, and whenever more than one projection was required, as many pictures had to be taken and afterwards aligned.

It must be remembered that photographs showing more than one view of

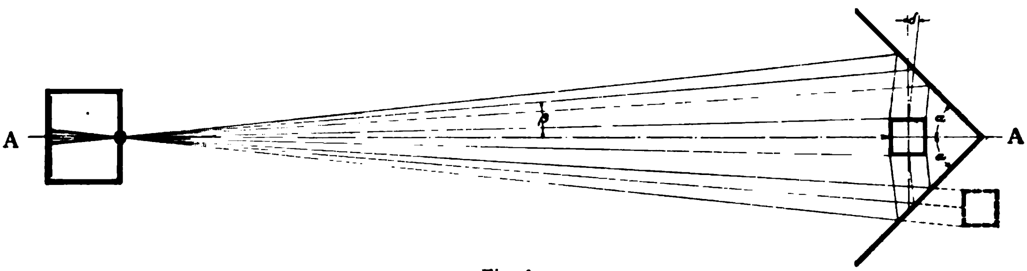


Fig. 1.

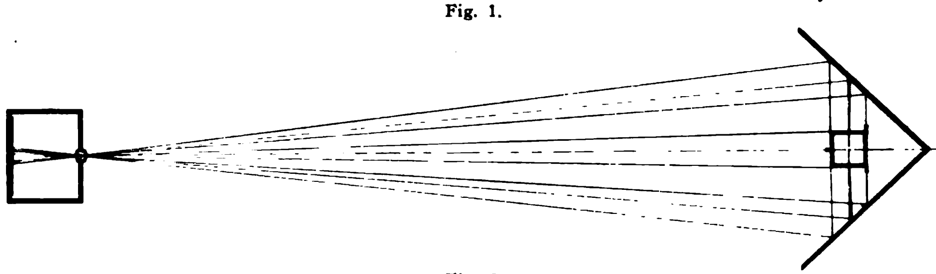


Fig. 2.

an object are not novel. They have been used to a great extent in advertising and catalogue work as well as in novel portraiture.

The possibilities of application of multi-view photography in orthodontia are obvious and almost limitless. Even ordinary photography has not been employed by many orthodontists to as large an extent as is possible. Quite often an object may be analyzed with considerably more facility from two or more projections than from the actual object. The advantages of photographs embodying front, right and left side views, and if necessary plan views of models or patients, over ordinary photographs, for purposes of diagnosis and record, are apparent. The elements of the technic will be discussed in the following paragraphs.

Fig. 1 illustrates the elementary principles involved. The reflecting mir-

rors are set at 45 degrees to the main axis A-A (a=45°). That the profile views will be distorted will be evident on inspection of the diagram. It will be noted no part of the profile view is a 90 degree projection of the front view.

Since all reflecting rays converge to the common focus about the center of the camera lens, they cannot be parallel, and hence the closest to a right angle projection that we can approach with mirrors set 45° to the main axis A-A (a=45°) is at an angle of 90°+d. It is interesting to note that if the camera were

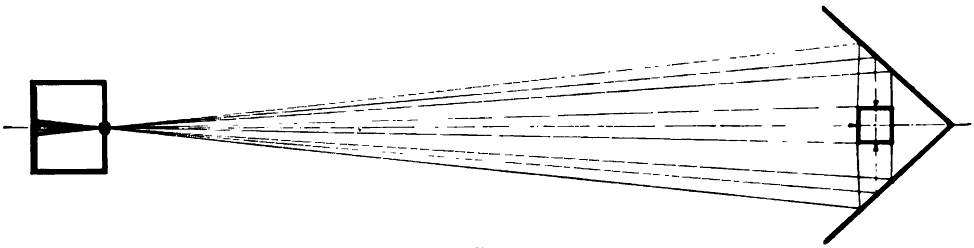


Fig. 3.

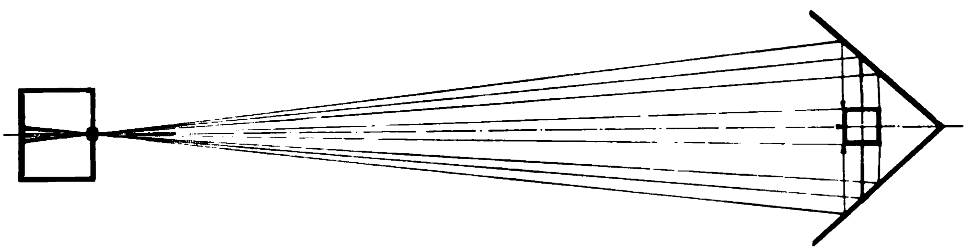


Fig. 4.

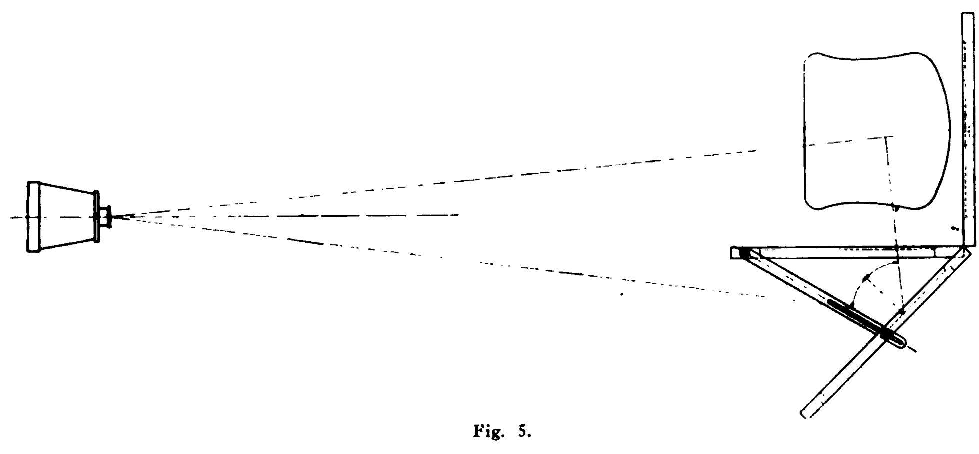


Fig. 5.

sufficiently removed from the object, d, and relatively B would be negligibly small and the projection would be practically without error. However, this cannot be accomplished with facility as the image would either be entirely too small, or special apparatus would have to be employed.

It will also be evident from the geometrical construction of Fig. 1 that since the reflected image is in back of the mirror, it will be further from the camera and consequently smaller than the direct view, on the photograph of the plate. This error is also practically negligible if the camera is far from the object; i. e.,

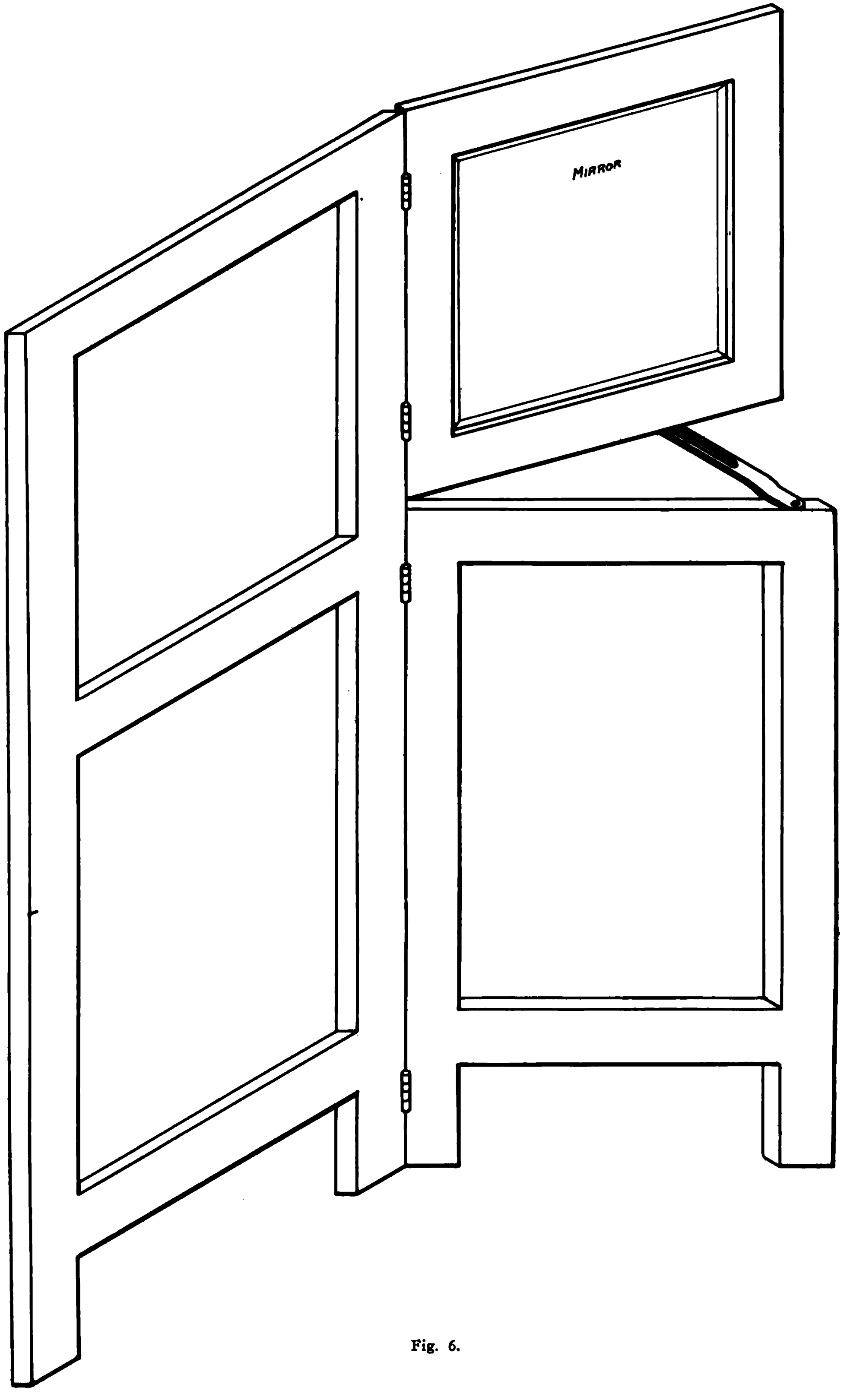


Fig. 6.

the percentage of error becomes less as the distance of the camera from the object becomes greater.

If it is desired to make corrections for this error, the object should be photographed in a scaled coordinate system, and each view compared with its respective scale.

Fig. 2 shows the object in the same position with respect to the camera, but the mirrors have been moved closer together, making the angle a smaller.

As this is done, it will be noted that the incident rays change their direction counter-clockwise. A point is then reached where the rays from one extreme of the object will be at right angles with the axis A-A.

In such a picture only the extreme of the end-projection would be undistorted. As the angle a is made still smaller the position of the perpendicular ray continues to advance.

It will be noted that a perpendicular projection is obtained either by making the angle B approach zero and hence negligible, or if the mirror is moved closer in, as has been done, the projection will also be perpendicular for a particular point on the object.

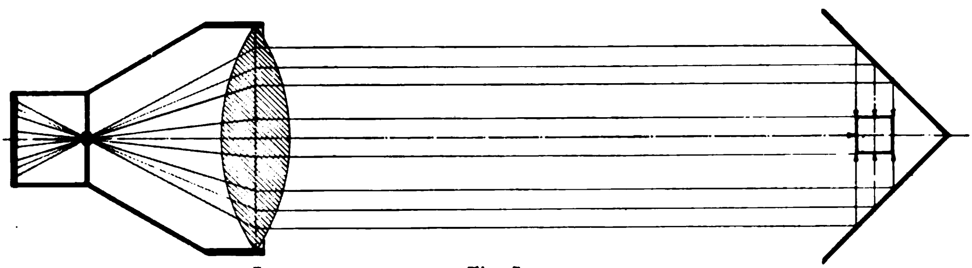


Fig. 7.

In Fig. 3 the center of the image is a true right angle projection, and in Fig. 4 the position has advanced to the other extreme of the object. If the angle a were still further diminished, the image as a projection would again be entirely distorted.

For the usual uses of photographs by the orthodontist the distortions due to perspective are negligible. The purpose of the above demonstration was rather to call the attention to those who employ photographs to the limit of their accuracy. The multi-photo reflector designed by the author is illustrated in Figs. 5 and 6. The manipulation is evident. The mirror may be adjusted to any desired angle, and the device is collapsible to occupy little space when not in use. Glass mirrors introduce many disturbances, increasing with the thickness of the glass, particularly that due to the reflection from the surface of the glass. The best results will be obtained with polished-metal mirrors.

Ordinary photographs cannot be used for precise work by the orthodontist without correction involving considerable mathematics. This procedure is obviously objectionable, and the author at first resorted to scale drawings which were soon superseded by mechanical surveys using the Stanton-Hanau Surveying Apparatus. This method was soon superseded by the ortho-photographic apparatus.

The principle of this device is illustrated in Fig. 7. It consists essentially of

an additional combination of lenses, represented by L, with a camera. The focus of this lens combination must coincide with the center of the camera lens.

It will be evident from the diagram that the reflecting rays to this lens will be parallel, and consequently all errors due to perspective are eliminated. With this device it is possible to make photographs that are entirely free from error, excepting that due to spherical aberration which also may be eliminated by the proper lenses. The main view as well as any reflected views are true 90° projections, such as are commonly used in engineering.

It must be remembered that in an image the right and left of the object are transposed, and the apparent confusion of the right view image with the left view image must be avoided.

THE HISTORY OF ORTHODONTIA

By Bernhard Wolf Weinberger, D.D.S., New York City.

(Continued from page 59.)

A. F. *TALMA*, in 1853, contributes in the *Dental News Letter* the following: "As a general thing, the irregularity of one tooth causes that of several others in the same arch and likewise in the opposite jaw. Thus, an incisor inverted or everted, or merely twisted on its axis, will cause its neighbor to incline towards it in an opposite position and thus the deformity may affect all the front teeth. On the other part, the corresponding teeth of the opposite jaw, being subjected to abnormal pressure during mastication and the occlusion of the mouth, depart almost necessarily from their regular position. From this ensemble of influences result combinations varying ad infinitum, all assuming the type of more or less shocking deformities, interfering with the due performance of functions and predisposing to the premature loss of the very teeth themselves.

"Among the cares to be bestowed during the second dentition upon the arrangement of permanent teeth, the extraction of deciduous or milk teeth is that which taxes most parents and dentists. It then appears obvious that in order that the tooth of replacement may have room to assume its proper position, nothing better could be done than to prepare that room in advance. But reason, and especially experience, modifying much this too hasty conclusion, two difficulties must at this juncture be carefully guarded against. The one consists in too early an extraction of the deciduous teeth, the other, in allowing them to remain beyond the necessary period.

"Experience and a considerate appreciation of the conditions of the dental system, can alone prevent the errors I have just pointed out, and fix the truly proper time for operating. I have ascertained that more frequent and serious irregularities are caused by too early extraction than by the opposite cause. The

deformities produced on account of having allowed deciduous teeth to remain too long a time in their situation very frequently correct themselves from the very growth and enlargement of the alveolar arch and of the whole maxillary. We should never forget that the crowns of the teeth after their eruption no longer increase in their size, while the bone which supports them remains for several years subject to the laws of the development of the entire system. Whence the results; that at the end of a certain time, some teeth which appear never to be able to find sufficient room, finally arrange themselves in the most perfect order, much to the astonishment of parents and often dentists themselves. When, in the cases, which I believe more scarce and resulting from special dispositions, the deformity is more considerable and appears to have a tendency to become permanent, we can still avert it by such operations as I shall point out subsequently. We shall find that in almost every case we can remedy the difficulty, while the exaggerated separation of the teeth, or the loss of those which have been sacrificed, ordinary results of an opposite practice usually leave no resource.

"To sum up, a long practice has demonstrated to me that the dentist as far as regards operations to be performed upon deciduous teeth, should observe the following rules as the most rational and the safest:

"1. So long as deciduous teeth remain firm, even when they begin to become loose, if no indication heralds the near apparition of the permanent teeth, nature should be abandoned to itself; there is no call for interference.

"2. When in front of or behind the milk teeth, still firm or already loosened appears a circumscribed reddish somewhat painful tumefaction, under which a projecting hard body may sometimes be felt, it is proper to extract that tooth.

"3. If one of the permanent teeth does not find, in the space left by the deciduous one, room enough to locate itself properly, and in consequence of want of room begins to deviate, we may extract the contiguous milk tooth.

"4. In certain cases, after having sacrificed accordingly with that which precede the deciduous canine to make room for the permanent lateral incisor, which we may be obliged still to extract the first bicuspid which appears at nine years, to make room for the canine which comes at eleven.

"5. We meet rather frequently with children whose canines are well set but have appeared before the first bicuspids, in such cases the lateral incisor not finding room enough in the arch, deviates anteriorly or posteriorly; its extraction then becomes indispensable. The ulterior arrangement may be left to nature, which will direct the other teeth towards the vacancy, and thus fill up the breach.

"I cannot repeat too often a counsel justified by preceding remarks,—the mouth of children should be, during the period of second dentition, examined regularly at suitable intervals by skillful dentists, who alone can appreciate the progress of dental eruption and rectify its irregularities at the proper time."

Again in June, 1855, there appears another article, *"Dental Orthopædia,"* translated from *Der Zahnarzt* by F. H. Rehwenkel:

"Inferior Maxilla.—In some instances the incisors of the lower jaw protrude so far as to overlap those of the upper. * * * * In some cases, the cutting edge of the incisors of the superior maxilla come in contract with the posterior surface of the lower gums, producing irritation.

"The above named deformity may depend either upon the anomalous direction, anteriorly, of the incisors of the lower maxilla, while those of the upper are in a regular and correct position; or the teeth of the superior maxilla may incline so much inwardly as to be quite behind the circle of the lower jaw. It is a matter of great importance to distinguish between these two irregularities; and this can only be done by a very careful examination, which must take place in early youth; for in later years, when the teeth are fully grown, the constant pressure to which they have been subjected will have changed their original positions and make the first cause, or starting point exceedingly difficult to ascertain. If it is found that the deformity consists of the protrusion of the lower teeth, which not infrequently is the case, even if those instances are excepted in which pressure is produced upon the teeth by hard tumors under the tongue, and which force them beyond the upper dental arch, it is advisable, in the first place, to direct our operations principally to the deviating organs. For the attainment of this purpose, the dentist must, after the removal of the cause or complications of causes which may be the occasion of the irregularity, commence his operations upon the lower dental arch by the same means which I heretofore recommended for the correction of deformities in the teeth of the superior maxilla; namely, the direct pressure, the palates, the bars, and ligatures. When the latter are adopted, they must be attended to carefully, and their action modified and regulated to the indication of the case. When the lower teeth are in a normal position, and the upper show the inclination to fall behind the former, circumstances must guide the choice of means used to correct the deformity.

"I cannot repeat too often that a deviation should be recognized in the beginning, and the proper measures taken for its correction.

"A narrow strip of strong plate is fitted to the posterior surface of the lower circle and secured to the molar teeth. This plate is perforated with pin holes opposite those teeth which incline too much outwardly. The rim must stand a little off from these teeth, which should have strong silken cords around them, the ends being passed through the holes in the plate. Thus in tying, we can bring to bear upon these teeth any amount of pressure desirable. In my long practice, I have met with many cases, which were so complicated as to render it necessary to use both the 'direct pull' and 'inclined plane;' the former, to prepare the way, as it were, and the latter to complete the cure.

"After correcting irregularities by rational means, the exercise of the proper functions of the teeth will be sufficient to consolidate them, and complete the cure. Not so, after luxation. In this case it will be necessary to support the organ in its newly acquired position for a considerable length of time, until it is again firmly imbedded in its socket. For each of my patients, I caused to be constructed a gutter similar to that of the inclined plane, which they were required to wear at night and as it fitted accurately over all the other teeth, the regularity of the latter was by these means preserved.

"To commence with ligatures, which are usually either silken cords or light wire, I have already pointed out the disadvantage connected with their use; they are as follows: Their action is not confined to the organ for which they are used, but exerts an influence upon several.

"When I speak in favor of ligatures, I mean, of course, only those of silk, or some vegetable substance, not those of a metallic nature, as they should never be used, excepting as a support for already adjusted teeth, and even then they cannot be employed without danger to these, as well as those to which they are fastened.

"Dental orthopædia must in its practical application be governed by general rules, which may be as follows: as much as possible to preserve and improve, and only in extreme cases to mutilate; proceeding always carefully, patiently, and attentively; ever remembering the injunction of our oldest masters—Principiis obsta."

H. S. Burr in the *Dental News Letter*, 1854, p. 221, describes and illustrates a flattened arch similar to Fauchard's, later adopted by many as being original. In treating *"Irregularities of the Teeth"* he says: "I commenced by fitting skeleton caps (of gold) to the first molars; a stiff bar was passed in front, one end soldered to one cap and the other end sliding in a groove. I tied the two first

Fig. 1.—H. S. Burr, 1854.

bicuspids and the two lateral incisors to the bar with thin strips of gum elastic. The strips, being stronger than rings, are preferable."

"I kept them tied with silk for a few days, and had a plate made to fit on the inside of the mouth and teeth covering the palatine arch, and extending down one-half the length of the teeth, with half springs inside the bicuspids.

"I will take this opportunity to mention the great and absolute necessity of studying the shut of the mouth before prognosticating that an irregularity can be corrected."

This description is not very clear but Fig. 1 shows the two forms of *skeleton caps.*

H. D. Ross.—The theory that irregularity may be due to thumb-sucking, which we hear of in modern times, was mentioned by different writers during the last sixty years. H. D. Ross speaks of it in 1853. At that time he remarked—this must have been observed as soon as there was an attempt at correction—that there is greater difficulty in keeping teeth in position after they are moved than in moving them.

A. J. French, in *Gaz. De. Med.*, Paris, is of the opinion that complicated cases of malocclusion can be entirely corrected if undertaken early enough. He

believed in the extraction of teeth. In 1854 he says: "Plates of silver accurately adapted to the roof of the mouth and secured with clasps to the molar teeth and by means of gold springs or spiral springs soldered to the plates, a constant and steady pressure may be applied in any direction. In cases where it is necessary to exert a constant outward pressure, spiral springs enclosed in tubes should be soldered to the plates in such a manner that the ends of the springs shall pass upon the teeth. The advantage is that it does not require rearranging except in 3 or 4 days, with slight inconvenience can be taken in or out and is a removable appliance."

Hamell, in a paper read before *The Mississippi Valley Association of Dental Surgeons* and published in the *Dental Register of the West,* on *"Irregularities of the Teeth,"* says: "The correction of irregularities of the teeth is among the first operations the dentist is called upon to perform. It develops itself as the teeth are developed, and becomes permanent as the teeth approach maturity.

"Seeing then that these are some of the results of irregularity in the arrangement of these organs, how necessary is it that we should be armed with a correct judgment and a cunning hand to enable us to restore erring nature to its proper place again. The benefits arising from regularly arranged teeth are numberless, the troubles arising from irregularity of the teeth are also numberless, and call forth our warmest sympathy.

"The tooth occupying the wrong place is not, in nine cases out of ten, the one that ought to be extracted; but one or more in the back part of the mouth, although they may occupy their proper places, must be sacrificed, that those in front, and which will more decidedly retain the contour of the face, may be brought into their proper places.

"The time of life, as laid down in the best dental works for the performance of this operation, is prior to the sixteenth year, though this operation may be performed after this time, yet with far less chances of success.

"Although the time we have mentioned is the proper one for correcting irregularity, yet a majority of those who make application for this purpose, defer it until they have arrived at their eighteenth or nineteenth year. And here a difficulty interposes, which is here to be disposed of satisfactorily to all parties. Who is to bear the blame for this delay of application? Is it the dentist for not placing the means of information on this subject in the hands of his patrons? Or is it these persons themselves for not informing themselves on the subject? We are rather inclined to give the dentist a balance, but not overmuch."

It is interesting to see the attitude taken by the dental institutions in their infancy towards the correction of irregularities of the teeth. For this reason, and more as a matter of historical record, the report of the commencement of the Philadelphia Dental College, as found in the *Dental News Letter* of 1854 has been included. Among the list of operations performed are seven cases of *"Irregularities of the Teeth."* We also find among the list of graduates several names that played an important part in the development of this important branch of dental science.

"This flourishing institution held its second annual commencement on the 28th of February, 1854, at the Musical Hall, Locust St. The hall was crowded

by a most intelligent audience. The proceedings were interesting and interspersed with music from a band engaged for the occasion. The able valedictory address was delivered by Prof. E. Townsend. After prayer, Prof. Ely Parry, in the absence of the president of the college, the Hon. E. K. Price, came forward and conferred the Degree of Doctor of Dental Surgery upon the following gentlemen:—Horton Baily, Pa.; William Calvert, Pa.; Firman Coar, Pa.; Al. G. Coffin, Mass.; E. H. Cogburn, Miss.; Ben. Cohn, Germany; S. W. Frazer, Pa.; W. Gorges, Pa.; Eri W. Haines, Del.; W. Storer How, Me.; Louis Jack, Pa.; Bernard J. Laughlin, Pa.; C. Wewlin Pierce, Pa.; I. Price, Pa.; David Roberts,

Fig. 2. J. D. White.

Fig. 3.—J. D. White.

Fig. 4.—J. D. White.

Pa.; J. M. Rothrock, N. C.; John R. Rubencame, Pa;. Thos. H. Shaw, Ala.; James Trueman, Pa.

"The honorary degree was conferred upon the following named gentlemen: John Tomes, London; J. G. Koehler, Schuylkill, Haven, Pa.; P. Beck Goodard, Phila.; Chapin A. Harris, Baltimore; F. M. Dixon, Phila.; Chas. Moore, Pottstown, Pa.; J. R. McCurdy, Phila."

"The appended statement taken from the records of the college shows that all the important operations usually coming in the range of ordinary practice have been demonstrated, for which no charge is made. The operations totaled 715. * * * * Treatment of irregularities, 7.

The year 1853 marks a change in the treatment of irregularities of the teeth, due to the discovery by Nelson Goodyear, of a method of vulcanizing rubber. The new product, vulcanite, quickly led to its adoption as a means or foundations for regulating purposes. However, as the same results were obtained by means of metal bands, "bracelets," etc., prior to its adoption, further than a new means of treatment, little progress was made through its use."

J. D. White. In the *Dental News Letter* for 1855-6 and 7, we find a series of articles by Dr. J. D. White, some of which are illustrated and are referred to as Figs. 2, 3, 4, and 5. These he describes (1855) as follows: "Nine-tenths of the cases of irregularities that come under our observation are the result of a premature loss of some of the deciduous teeth.

"The prognosis depends upon their want of knowledge as to the means necessary to accomplish the object. If those dentists who cannot see how they are to be paid for their services were to give proper attention to a few cases without any hope of direct remuneration, they would be paid in information much more than in the services rendered the patient."

On page 184, 1856, he describes as follows:

"Fig. 2 is the case viewed from the left side; the first superior bicuspid, canine, lateral incisor, and both front incisors falling inside of the lower teeth, which gives a lateral and forward projection to the chin and a peculiar warp to the face.

"Fig. 3 is the apparatus for the upper jaw; it consists of a plate swedged up to fit the roof of the mouth, and extending forward against the back part of the front teeth, in the same manner as if it were intended to insert teeth upon. It has attached to it, on the left side, an inclined plane, opposite the superior canine and lateral incisor, extending outward and downward, to grasp the inferior canine and bicuspid. This answers the double purpose of helping to throw the upper teeth out and the lower ones in, and the lower jaw to the right. It also keeps the jaws apart sufficiently to allow the teeth, when they are moved, to pass each other. The bands are so constructed as to grasp over the crowns of the molar teeth in such a way as to not require filing. To the buccal sides of these bands is soldered a bar extending from side to side, and as far away from the front teeth as it is desired for them to be brought forward. To this bar, and around the necks of the teeth ligatures are well fastened, either of India rubber or flaxen thread. This apparatus must be changed every other day, and the teeth well brushed to remove all foreign substances. There are also attached to this plate caps for the back teeth to prevent them from falling toward the opposite jaw while the apparatus is worn. This fixture was worn about one week before anything was done to the lower jaw, when a simple bar and caps were placed upon it, as seen in Fig. 4 [Fig. 2]: a, is the bar in front of the teeth; b, a spiral spring at one extremity to give elasticity to the bar when placed over the front teeth; c, the bands over the second molar teeth, with caps extending over the wisdom-teeth in the same manner as the upper caps, to prevent them from rising from their sockets. This spiral spring has within it a piece of wire to prevent it from bending laterally, but it does not prevent the extensibility of the spring."

Again in the *Dental News Letter*, Jan., 1857, p. 188, in speaking of *"Irregularities of the Teeth,"* Dr. White wrote:

"We referred in our last article on this subject, to the fact that the majority of cases of irregularity was the result of premature extraction of the deciduous teeth, we referred only, at that time, to the front incisors, but the same rule applies to the rest of the deciduous set. The cuts then given did not well illustrate our cases, but it was discovered too late to have them corrected. It is a very beautiful operation to correct a difficult case of irregularity of the teeth but it is in our humble opinion a much greater triumph of skill to prevent its occurrence. Every writer censures the parents for not attending to their children's teeth, so that such cases shall not occur, but the truth is the other way, if neither the parent or dentist meddles excepting in plugging the first set, irregularity rarely occurs."

In the January issue, 1859, of the above mentioned journal, Dr. White illustrates his method of correcting the *"Projection of the Lower Jaw"* by the use of the chin cap. As his method was similar to the one already described by Fox, and similar to Westcott's (1844), it will not be necessary to go into the detail of same.

Fig. 6.—Bar used by James Taylor

Fig. 5.—Hinged plate as used by J. D. White

Again in the *Dental Cosmos*, Jan., 1860, p. 281, we find another appliance as devised by Dr. White for *Expanding the Jaw* which he describes as follows:

"The following is a very simple but effectual method of expanding the superior maxillary: * * * * By placing a plate in the roof of the mouth as far up as it can be extended, but cut through, to make two halves, with a hinge in front, back of the incisors; this plate or plates opens and shuts like a hinge. These plates are fastened to the first molars or bicuspids, as the case may be, and a spiral spring is attached on either side, with the bow of the spring extending around behind the front teeth and close to them so as to be out of the way as much as possible. * * * * We regard it as necessary that the whole jaw, teeth and all, should be moved together, to insure success. The accompanying figure shows the apparatus: A is the plate; B, the crib bands for the first molar teeth; C, the spiral spring; and D, the hinge joint (Fig. 5)."

James Taylor describes a new and interesting way to correct irregularities, in the *Dental Register of the West*, 1855:

"We constructed a bar represented in Fig. 6. This bar is just long enough to allow its end to rest on the cuspid teeth, and is so bent at the ends as to partially embrace their labial face.

"Two small hooks are soldered to this bar, one of which hooks over the cutting edge of the left central incisor, and the other over the edge of the right lateral incisor. They are made of small strips of ordinary gold plate. This bar is made of two strips of gold plate soldered together, first having been adjusted with pliers, to fit the front teeth, standing off of the irregular tooth, so as to permit traction to draw it to its proper place. The hooks kept the bar far enough below the gum so that the ligature which passed around the irregular teeth and was tied to the bar, kept the thread from irritating the gum,—a few days sufficed to bring the tooth to its place—the ligature should be removed at least every other day and be reapplied, this gives opportunity for cleansing the teeth and tightening the ligatures.

"The first step in the operation to restore symmetry in this case, was to take an accurate impression of the upper teeth; this was done in the usual manner with wax, and from this a plaster model was procured. We then took a piece of gold plate of ordinary thickness, for under sets of teeth, and about one or two lines wide; this was bent into the circle—into which we wished to bring the teeth—either end of this bar resting on the anterior molar teeth, and its center merely

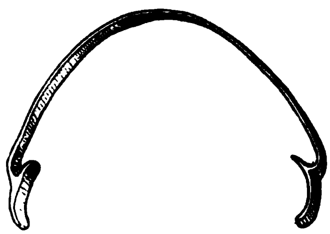


Fig. 7.—James Taylor.

touching the incisors. A second piece was then made like the first, and these soldered together and then filed up to the size we wished.

"Clasps were then fitted to the labial face of the molars, passing as far between these and the posterior bicuspids as was practicable. The bar was then soldered to these, as is represented in Fig. 7. When applied, it is attached to the molars by the clasps, and circles from these around in the proper circle of the teeth, resting on the central incisors; the bicuspids or cuspids stood within this circle about the thickness of these teeth.

"This we accomplished as follows: First wedge the teeth apart sufficiently wide to allow a good sized gold wire to pass between them. We then adjust a gold bar, extending from the lateral approximal edge of each tooth; this is fitted to the lingual face of these teeth, and stands off from them at the medial line; a hole is made in the bar parallel with this line, and a gold wire inserted and soldered fast. This wire passes between the teeth and is sufficiently long to pass through a gold bar which is adjusted to their labial face, on the end of this wire is cut a screw, and for this a tap of thick gold plate is made. When this fixture is applied, the tap or nut is screwed on until it is drawn tight on the teeth; and every day or every other day screwed up a little tighter. Each day brings the two gold bars nearer together, and hence turns these teeth in their sockets."

Fred J. Clouston, 1856, in the *British Journal of Dentıl Science*, p. 47, on *"Irregularities of the Teeth,"* says:

"The lower teeth bit outside the right lateral and left canine, and both the deciduous teeth were still quite firm, which I, of course, immediately extracted, together with the first bicuspid on the right side, which prevented the cuspidatus from assuming its position in the arch. I then adopted a large plate to the palate, capping the molar and bicuspid teeth, to which I firmly attached the piece by clasps; and here I would remark that a great deal of time and trouble may be saved by securely fastening the plate to the masticating teeth, so as to obtain what mechanics call 'a good purchase.' This should be attended to in all cases, whether the teeth are to be drawn in or pushed outwards. I then fastened India rubber cushions to the plate, so as to press against the three teeth to be moved, and drew the lateral away from the central incisor, it being pressed against that tooth and forming an obstruction to its coming outwards. I accomplished this by means of a ligature passed around the tooth and fastened to the plate."

Another article in the above named journal (p. 171) by an anonymous writer describes his method as follows:

"I extracted the first bicuspid on either side, and made a strong gold plate for the lower jaw, capping all the teeth, with a projecting lever on each side for the lateral to bite on. At the same time, I applied elastic bands from the molars to the canines on each side. This action was kept up, occasionally altering the pressure, for about two months, until the laterals were sufficiently forward to escape the under bite. I then made a plate for the upper, still keeping the pressure on the laterals, and conveyed an elastic from the center of the palate to a crossbar outside the centrals.

"I have invariably accomplished much more by adopting plates to the under than the upper jaw. The patient has less annoyance, and the operator obtains a greater pressure by the action of the lower jaw than can be gained by India rubber cushions."

Samuel Maclean read before the *Odontological Society* of London, Feb. 28th, 1857, and published in their transactions, a paper on *"The Removıl of the Four Permanent First Molars, in Certain Cases, at an Early Period of Life."*

"The practice, as I have said, which it is my object to advocate in the present communication, is the systematic removal of the four permanent first molars whenever the arch has a decided tendency to be overcrowded, and especially when the teeth in question are affected by caries.

"I now proceed to consider more particularly the advantages connected with the practice I am advocating, and also the objections which may be urged against it. The advantages I conceive to be as follows:

"1. The prevention and correction of the simpler forms of irregularities in the easiest and most desirable way, in a great majority of cases, without the aid of mechanical means; in all, in such a manner as least not to disfigure the appearance of the mouth.

"2. The promotion of a healthier state among the remaining teeth, and an increase in the facility of treating caries when it presents itself.

"3. The prevention of the distressing, and in some cases even very serious

symptoms, which frequently accompany the development of the wisdom-teeth in over-crowded arches, and a material diminution in the chance of the formation of sinuses in after life.

"The question really at issue is: 'How are over-crowded arches most effectually and most safely relieved?' The cases I have brought forward in support of my view are sufficient, I think, to justify the course I am advocating.

"I now proceed to consider the objections which may be urged against this practice, and the disadvantages connected with it.

"1. Its apparent severity, and, in the eyes of sensitive persons, even cruelty.

"2. Its apparent needlessness at the time of operation.

"3. The slowness and self-operating character of its results.

"4. Its occasional difficulty."

W. H. Allport, Dental Register of the West, 1858, p. 21, reported the following case of irregularity and method of treatment.

It is a case that occurred recently in his own practice, and was an extreme case, one that by the ordinary mode of treatment would have been very difficult,

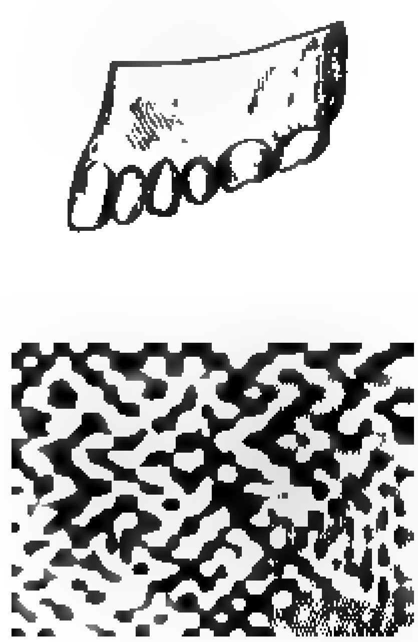


Fig. 8.—Method devised by W. H. Allport.

if not impossible, to correct. The appliance is something new, and proved very efficient in a comparatively short time. The teeth now occupy a good position. The operation produced an entire change upon the face of the patient. The following description of Dr. Allsport's is very clear and concise and by the aid of the cuts, will be at once comprehended:

"Fig. 8A represents the teeth at the expiration of five weeks after the apparatus was applied.

"Fig. 8B represents the plate, clasped to two molars, on each side, with the band extending around the outside, and to which are soldered two hooks (a a) passing over the ends of the incisors to prevent the band slipping too high upon the teeth. To each end of the band is attached a screw (b) passing through a nut (c) soldered to the clasp, and by means of which the band was tightened every other day, on each side of the mouth with a screw driver (d).

"This process was continued for five weeks; the whole was then allowed to remain without further tightening for two weeks longer when the apparatus was removed.

"To retain the teeth in this position, a plate was again attached to two molars with narrow strips of gold soldered to it, passed over the inside, and hooked to the ends of the incisor teeth.

"During the whole process, the patient made but very little complaint of soreness or of inconvenience from the apparatus. The patient was a lady of twenty-two years of age.'"

H. E. Peebles, 1858, pp. 64, 117, *American Dental Review* first describes the condition of the patient:

"In this case three defects existed and demanded attention; viz., there was not space enough between the left and right first bicuspids, the mouth was too narrow; secondly, it was too long; i. e., the incisors projected too much; and last, but not least, the arch was broken and irregular.

"We first widened the mouth, between the bicuspids, full three lines; we shortened it two lines, and repaired the broken arch by gently pressing the deviat-

Fig. 10. The use of the screw as explained by H. E. Peebles.

Fig. 9.—Dr. H. E. Peebles.

ing members into their line, and thus restoring to the face its wonted order, symmetry, and beauty.

"She was discharged with a gutta percha support in the mouth to retain the teeth in situ, and directed to wear it one month."

On page 117 Dr. Peebles says:

"On the cause or causes of irregularity of the human teeth, there need be very little said at this time and in this place, as I presume we all agree that want of room, owing to a poorly developed maxillary bone, induced mainly by our artificial mode of life, extending down through many generations and co-extensive with our civilization.

"But upon the treatment it may not be inappropriate for me to say a few words. I deem all cases of irregularity, so far at least as they have fallen under my observation, remediable or curable. I prefer taking charge of such cases, as a general rule, at a period of age above, rather than below twenty-five years of

age. I then have a mature mental and moral as well as a mature physical subject to deal with.

"I have lately tried the screw as a motive power, with which I am so well pleased, that nothing short of a patent taken out for its application would induce me to abandon its use. (See Fig. 10.)

"I find little trouble and complaint in consequence of soreness under the pressure of the screw, but a great deal from elastic ligatures. I think that the people are not generally well informed in regard to the importance and practicability of this operation, and here let me suggest the propriety of adopting some means whereby the community generally may be educated on this subject."

Spalding, in the same journal, said he regarded premature extraction of the deciduous teeth a fruitful cause of irregularity. He also thought there existed causes, having their origin in the constitution, and resulting, in part, from the fusion of races, which has long been going on, on this continent. "Different races of men, or different families of the same race, are often marked by some particular configuration of the teeth and jaws. Sometimes we find the teeth large and broad, accompanied by a corresponding breadth of arch in maxillary. Sometimes we also find the teeth small and narrow with an arch corresponding thereto. Now suppose we bring together persons of these different types, and their offspring should inherit the configuration of the maxillary from one parent and the form and size of the teeth, from the other; the result would be obvious; the teeth would be either scattering or crowded; and in the latter case the interference of art is often required."

In the treatment of irregularities, he was often compelled to extract. In correcting slight irregularities in the teeth of children he depended mainly upon such pressure as could be exerted by some instrument in the hand, applying as much force as the teeth would well bear once or twice daily, until the tooth became sufficiently loosened to admit of being brought at once into its proper position. He then, when necessary, bandaged the face so as to maintain the occlusion of the jaws until the tooth would retain its place. "A single night is sufficient to accomplish this, although a longer time is sometimes necessary."

H. J. B. McKellops in the *American Dental Review* of the same year did not agree with Dr. Spalding in the view put forth as to the effect of mixed races. Thinks no rule can be adopted which shall be found applicable to all cases, but that the proper course of treatment would readily suggest itself when the case to be operated upon is presented.

He describes a case of protrusion of the lower jaw, caused by a false articulation, which he had treated successfully. To regulate the point of occlusion, he extended the lower molars by the use of blocks of gold attached to the teeth by clasps; these blocks were reduced by the file as the treatment progressed. The protruding chin was gradually brought into its true position by the use of Fox's bandage, which was tightened daily. The time occupied in bringing into position was about four months; treatment, however, will probably be necessarily continued some four months longer, in consequence of the shortness of the molars, the growth of the upper ones especially, having been checked during their eruption by the manner in which the teeth at that time articulated.

W. Dalrymple, in 1858, *American Journal of Dental Science,* p. 56, on *"Deformity Occasioned by Contraction of the Arch of the Superior Maxillary, and Irregularity of the Teeth Successfully Treated,"* says:

"My first object, so to speak, was to unlock the jaws, and to break up the constant tendency by shutting the mouth, to increase the difficulty. This was done by first preparing a firm plate for the basis of my future movements, upon which was soldered studs to keep the jaws apart, to break up the articulation and at the same time so arranged as to act as inclined planes in moving the two sides of the upper jaw outwards or from each other whenever the jaws were closed.

"I also used a bar of wood reaching from one canine tooth to the other, and of such length as to press firmly upon them. This was supported in its place by a plate that was swaged to fit accurately to the palatine portions of the upper jaw, and about the necks of the teeth. To this was soldered two loops through which was passed the bar or brace. These were renewed and lengthened from day to day."

Again in the *New York Dental Journal,* p. 121, we find the following:

2

Fig. 11.—W. Dalrymple, 1858.

"I took an impression of the mouth, and struck up a plate fitting accurately to the posterior surface of all the teeth and clasped to the temporary molars. By this time, the lateral incisor crowding inwards and contracting the arch, we soldered to the plate immediately opposite this offender a little socket (see Fig. 11) with the palatine end closed. In this socket was placed a plug of hickory wood, (b) which was lengthened from time to time, fitted so as to press firmly upon the tooth, which operation had the effect in a few weeks of giving me room to operate upon the transverse central. I now fitted a band encircling it quite near the gum; to this was attached an arm (d) of spring wire, and soldered to the posterior portion of the plate covering the mouth, having considerable length, that it might force the tooth around. The arm was changed from time to time, until I had the satisfaction of turning a tooth completely on its own axis."

N. W. Kingsley. The first article to be contributed by perhaps the foremost of the early modern pioneers in our branch of dental science, we find in the *New York Dental Journal* of 1858. Kingsley, closing this article saying, "Begging

your indulgence for occupying so much of your space in this, our first communication to any Dental Journal" could hardly dream of the vast amount of space the literature he wrote during his brilliant career would consume. *"On Irregularities of the Teeth—Treatment,"* p. 81, he wrote:

"A hickory stick, well known to the profession as pivot wood, of proper length was first placed across the mouth and forced between the second bicuspids, that being the point at which the greatest expansion of the jaw was required. This was renewed daily, forcing in a longer one each time.

"Another was added after a few days between the right first bicuspid and left lateral incisor; also changed from day to day. Three or four weeks sufficed to force them out all that was desirable. A gold band was then bent to a comparatively true curve, reaching from molar, resting on the labial surfaces, around to molar and tied with floss silk to those teeth which had been forced into position by the braces; the branches still remaining to keep them in their place. Elastic rings were cut from small rubber tubing, and slipped over the remaining teeth and drawn outward and tied to the gold band. After a few days the braces were removed, the band acting upon the teeth in a manner to hold them without the aid of the braces; the band was removed, new ligatures applied, and the teeth cleansed thoroughly twice or three times a week. From four to five weeks brought the teeth all into a good position. A plate was then fitted to a model, obtained in the usual manner, extending back to the molars and across the palatine arch, and tied to the bicuspids. This was worn from three to four months, until the parts became settled and firm.

"In remarking upon this subject, I cannot avoid contrasting the plan of using braces and ligatures with the inclined plane, which, until quite recently, was the almost universal recourse with the few who attempted the correction of irregularities. From the supervision of a large number of cases, and the observation of its actions and results in others, I am led to believe the inclined plane defeats its own purpose. Its action is well known; its intention is to strike the offending teeth at every occlusion of the jaw, and thus force them into position. But as the class of patients requiring treatment is confined to youth, the teeth in a few hours become tender to the touch, when they will sooner go without masticating their food than strike the teeth with sufficient force to produce any movement, and unless all the masticating teeth of one jaw are covered and very accurately articulated to the others, a worse result is more than likely to happen; viz., elongation of the molars and bicuspids and entire change of articulation.

"Neither do I regard it as necessary that blocks should be built on the molars to masticate upon, in a case, for instance, where the superior incisors close within the inferior; but a very few days are required in the passing over, when the molars would be required to be kept apart, and there will always be more or less tenderness of those teeth firmly braced, which will prevent the patient from biting with sufficient force upon them to drive them back. A patient would not acquire sufficient command of masticators in so short a time to make them of any material service. Neither would I approve except in rare instances, of the extraction of permanent teeth that stand out of the arch, because the arch is nearly full without them. In a majority of cases the jaw can be expanded, and they restored to

their normal position. I believe nature to be the best model we can follow, and no one can doubt but it is her intention, and, as a general rule, most conducive to the beauty of the individual, that all the permanent teeth should stand in the arch.

"In these days of the rapid increase in the number of those who require the skill of the dentist in developing the beauty of the permanent teeth, it becomes us as a profession to bring to our aid all the resources of science and art.

"It is surprising the vast amount of culpable ignorance daily and practically displayed by the profession, even in regard to the development of the permanent teeth.

"Removing temporary teeth to make room has been the cause of more irregularities than Dame Nature was ever guilty of."

Again on page 117, we find *"On the Treatment of Particular Classes of Irregularities,"* by N. W. Kingsley.

"I despise, as much as any one, hobbies; but no man ever made any progress, beyond what was laid down in the books as orthodox, who did not, in the opinion of some, ride a hobby. Consider then, for the moment, regulating teeth as my hobby.

"The increased interest which this excites in the profession induces me to comply with your request to send you the following article on *'The Treatment of Particular Classes of Irregularities.'* Commencing with the central incisor of the upper jaw, the most common form of disarrangement is when one central falls within the lower jaw, and is held thus out of its arch at every occlusion of the jaws. If the patient is young, say under twelve, the treatment is simple, and the progress rapid. A gold band of half round wire, bent to the curve of the jaw, placed on its labial surface, its end supported by tying with floss silk ligatures to some of the back teeth, and a ring cut from small India rubber tubing, is all the fixture necessary. If the temporary molars are in, and tolerably firm, the ends of the gold band may be tied to them; no harm can follow, as there is no strain upon them. Before fastening, slip the rubber ring on the band, and when the band is secure in its place, bring the ring opposite the offending tooth, and stretch it over it. No blocks are necessary to keep the jaws apart. No matter how much the lower teeth lap over it—unless the jaws are bound together—the action of the gum elastic will bring into line within a few days, and, ordinarily, with very little soreness. The rubber rings ought to be changed often, as they lose their elasticity. When once lapping outside the lower jaw, there is no danger of their getting in again.

"Another form of irregularity of the centrals is, when they stand obliquely to the arch, their labial surface describing two sides of a triangle; or, as may happen, one or more standing directly across the jaw at a right angle with it. The treatment, as usually given, is a complicated one. Sometimes a fruitless effort is made to fit a gold collar so firmly to the tooth that a short lever soldered at a right angle to it will, by the aid of elastic fastened to the end of the lever, pull it around; a very pretty way of accomplishing the object in theory; but unfortunately; the practice in a majority of instances (owing to the difficulty of making the collar hold) does not sustain the theory; besides, even if it could readily be made to hold, the fixture is a cumbersome thing. Another splendid piece of steam-

engine machinery to attain the same object, I saw in the mouth of a little miss, between nine or ten years of age, a few days since. A central incisor was slightly twisted from its true position, a gold plate was fitted across the entire palatine arch, passing over and covering the crowns of the molars, a gold bar was soldered to the plate on the labial surface of the molars, passing around in front, resting on the outer corner of the offending central and farther on soldered to the palate plate on the opposite side of the jaw from where it started; so much to keep one corner of the tooth where it belonged. Another plate was fitted over the lower jaw, with an inclined plane to strike the opposite corner of the tooth, and twist it into place—beautifully—only, after wearing it between two or three months, it didn't. The author of this wonderful piece of mechanism has, within a couple of years, obtained a patent for his great improvements in dentistry, in making—never mind; spare him.

"The accompanying engraving will illustrate a much more simple and effectual method. It represents the jaw of a miss, 13 years of age; the irregularity of the incisors successfully corrected by the following treatment. Fasten a gold bar as before described, file notches in it as follows, one on each side

Fig. 12.—The first method of N. W. Kingsley to correct irregularities of the teeth, 1858.

against the space next the laterals; before tying the band in situ, take two elastic rings, tie them to the central notches, stretch one of them one way to the notch and tie it, the other in a contrary direction, and fasten it. (See Fig. 12.)

"Secure the bar in its place and carry the elastic bands over the teeth. The engraving will show the triangular form the rubber band is compelled to take. Common sense will explain its action—a month with a young patient will accomplish the result. I care not how much trusted a central is in the jaw, so surely as India rubber is elastic so certain is success. Essentially the same treatment is required when one central, in addition to standing obliquely, laps over the other central; to bring it down into line, or any other tooth that stands too prominent, instead of floss silk ligatures at the end of the gold bar, use elastic rings tied to notches—for instance, file the notch from one-sixth to one-eighth of an inch, formed of the first molar, on each side, fasten the rings to the bar and stretch them back and over the molar. The effect will be a constant backward strain on the gold band, which, resting on the too prominent teeth, will force them down into line. The following treatment is peculiarly applicable to the lateral incisors of either jaw, and consists of ligatures and gum elastic only. The usual manifes-

tation is the dropping of the laterals within the lower ones. Wax a strong silk ligature around the first molar and the bicuspids back and forth, so that the three may be bound together, and may form an anchorage; treat both sides in the same manner. On one side fasten an elastic ring by the ends of the silk, close up the bicuspid.

"Another manifestation not uncommon is the eye-tooth closing within the lower jaw.

"It can be restored with a band and elastic, or a wooden brace across the mouth. The only difficulty is owing to its peculiarly inclined conformation upon its lingual surface. A ligature or brace will be very apt to slip off. In such a case the following is certain: with a very small diamond pointed drill, make

Fig. 13.—Dr A. Westcott.

a hole high up on the swell of the tooth on the inside about one line deep. Fit a piece of condensed hickory for a plug—with the end standing out sufficiently long to catch and hold the brace or ligature.

"In the end plug with gold. Of two evils choose the least—it is better to drill the hole and restore the tooth than submit to the deformity."

A. Westcott, 1859, *Dental Cosmos*, p. 60, undertook the correction of the entire maxilla. In his account we find several novel and interesting appliances of metal for both lateral and anterior expansion. *"A Case of Irregularity."*—"It is a case presenting a combination of difficulties—not merely one of great irregularity of teeth among themselves, but this was accompanied by a jaw so contracted

as to allow the entire circle of the upper teeth to shut inside the teeth of the under jaw.

"I take occasion here to say that, in my judgment, plates, as the base work of any fixture whatever, in cases where the object is to expand the jaw itself, are wholly inadmissible. I do not say that it would be impossible to effect the object in this way, but while they are very insufficient, they require as much tending as an infant, and, at that, will need renewing at least once a week. No one man, by devoting his whole time to this kind of apparatus, could possibly have under treatment more than five patients at a time; and, at that, his own nerves and his patient's gums would be alike in a state of constant irritation. They are neither capable of self-adjustment, nor of being adjusted, unless reswaged.

"I conceived a plan by which I might dispense entirely with plates, and supply their place with a simple, governable, and almost self-regulating fixture—one which could be managed by the patient safely and efficiently, for from one to three weeks at a time, without any attention on the part of the operator, and then requiring not more than ten to thirty minutes.

"My first object had been, and still was, to expand or spread the jaw laterally—the upper jaw being, at a point opposite the bicuspids, nearly half an inch too narrow to articulate properly with the corresponding teeth of the lower jaw.

Fig 14.—A. Westcott's method "to expand or spread the jaw laterally."

Fig. 15.

"This consists of double clasps, (for each bicuspid) and both soldered to a cross-bar, bent so as nearly as possible to fit the arch of the jaw. This was fitted in all respects as clasps are fitted to a plate, only substituting the bar (made of silver wire, No. 17) for the plate. This was made to fit snugly and firmly, and placed upon the teeth, with directions that the patient return the next day.

"This fixture worked very well and made fine progress, and the only drawback seemed to be that it was too constrained in its action, and was inclined to irritate the gums. It then occurred to me that this difficulty might be overcome by attaching the clasps to the bar differently, by letting the attachment be a hinge joint, that should indeed have some freedom of motion in every direction, and accordingly I substituted for the first, the fixture seen in Fig. 14. This consists of the double clasps, as described above, to which was soldered semicircular flat pieces, for the double purpose of receiving a pivot, and as a protection to the gum about the teeth. The end of the bar is then flattened, or an eye soldered on to it, (which is better) and attached to the flat pieces on the clasps by a firm rivet. If it is desirable to move both bicuspids equally, and it is found they move with equal pressure, this rivet should, of course, be placed so as to bear directly midway between them. It will readily be seen that this is a fixture which will

perfectly adjust itself to both teeth at the same time. The pressure against the teeth with this appliance is regulated, as in the first case, by periodically straightening the bar.

"My next statement was the fixture represented in Fig. 15. This consists, as in the former pieces, of double clasps (a a) taking the places of those on the bent bar. These clasps are connected by a straight bar, which is made nearly the whole length of tubular wire. This tube has a screw cut in its inside the whole length, and is soldered to one pair of the double clasps. The other pair of clasps are soldered to a wire which screws into this tube, the object being to lengthen or shorten the bar at will. The clasps being nearly fitted to the teeth, and the bar so adjusted as to admit of their setting easy, we have the starting point. I will incidentally say here, that I am by no means certain, but that this fixture thus far described, (attaching the clasps as in Fig. 14) might with advantage, be submitted for the bent bar heretofore described, for getting lateral expansion in all cases.

"To complete this fixture for the purpose of moving forward the front teeth, I next soldered a flat piece (c c) of sufficient width for hinge joints to connect with it the tubes (d d d d) which are to receive the spurs, (e e e e). These tubes, which have a screw cut on the inside, are attached to the flat piece on the bar by first soldering to the end of each an eye, (f f f f) consisting of a flat round piece to receive the rivet holding it to the main bar. Into these tubes are screwed the spurs, which are to bear and press against the teeth to be moved. These spurs are kept in place against the teeth by making a slight depression in the teeth themselves, with such a drill as is used for drilling steel or other metals.

"When the apparatus is thus prepared, the clasps are adjusted firmly, and these spurs are brought forward, and the points inserted into the depression in the teeth—each one being so adjusted by its screw in the tube as to exert a gentle pressure against the tooth. As to how many of these spurs shall at first be put on, must depend upon the number of teeth to be moved, and, of course, upon the judgment of the operator.

"The primary objects to be kept in view in deciding upon fixtures for regulating the teeth are to choose such means as shall exert firm and steady pressure, that require the least possible alteration, that their periodical adjustment shall be simple and easy, and, if possible, such as can be managed by the patient. Anything short of such an arrangement requires an amount of time, and involves a perplexity on the part of the operator, which must constrain him either to discard such cases or to charge such a price that would, in most instances, be beyond the means of the patient.

"Before closing this article, I wish to make a few general suggestions to the young practitioner, which may be of service to him in his management of this very interesting, though often perplexing, class of dental operations.

"1. Never undertake to regulate teeth until the first set of teeth are shed, and the second set are in their place. I do not mean by this, that we should never attempt to prevent irregularity by timely extraction, and perhaps by other means.

"2. When a case is presented, and the proper time has arrived for commencing operations, let the inquiries be—'Does the patient, or the parent, or the guar-

dian, fully appreciate the nature and importance of the operation, so much so, as to place the patient fully at your control, and cheerfully to remunerate you for your time and skill?' If both these interrogatories are answered affirmatively, then you may safely undertake the task; but if either are even doubtful, and especially the former, you had better dismiss the case.

"3. If you decide to commence the operation, take accurate impressions of both jaws, and of the two in combination, or an articulating impression; and, before you see your patient again, or prepare any fixtures, study them carefully and thoroughly, and come to definite and distinct conclusions before you make the first move that is seen by the patient.

"4. Set the price, if you can, before you commence, and require at least one-half in advance (which often secures a punctuality which nothing else will) and be sure to set it high enough, (and there is little danger of your getting it too high) and then be faithful to the last degree, whether you make or lose money. Never curtail any effort for fear your arrangement may not prove profitable.

"5. Consider well the constitution and the health of the patient. If the constitution is naturally feeble, and especially if the health is bad, better by far run the risk of confirmed irregularity than undertake any of this kind of much magnitude.

"6. Never be discouraged, my young friend, at a failure.

"I have drawn out this article to a degree of prolixity otherwise wholly unpardonable, expressly to show you that twenty years' experience cannot exonerate us from disappointments and failures; and also to show you that these may be overcome by close study and patience. Because you have been successful in one case of regulating, it does not follow that you are prepared to start off at railroad speed on the next. Every case is a new one, and however well you may be posted in general principles, you must study this particular one as closely as if you were in fact a beginner. No field in dentistry presents greater scope for the exercise of close study, the correct applications of principles and sound judgment, and none, if successfully cultivated, yields a richer reward in the satisfaction it brings to the operator."

In 1844, *American Journal of Dental Science*, p. 147. he illustrates and describes the *"Operation for Correcting Protrusion of the Under Jaw."*

"We have seen a single instance which, from the great length of the under jaw, we not only presume was congenital, but that a remedy could never be affected by art. In this instance the lower jaw could not have been dragged from its natural position by the upper teeth, as the incisors of the lower jaw were at least half an inch anterior to the corresponding ones of the upper jaw.

"In the treatment of this case we followed, with a few exceptions, the directions of Dr. Gunnell, of Washington City.

"In this case, we first prepared a plate with clasps, in all respects, as we would do with the view of inserting plate teeth.

"The clasps were attached to the first permanent molars, (the second not having made their appearance) and so that the whole could be easily removed and replaced by the patient. To this plate, just within the circle of the clasp and inside the teeth, were soldered standards, resembling the linings of plate teeth

and passing sufficiently below them to admit of the blocks being attached, which was done by a gold rivet. These blocks were of such thickness as to separate the points of the incisors about one-eighth of an inch. We greatly prefer this method of securing the ivory blocks in their proper position, to that described by Dr. Gunnell, for several reasons. In this way we obviate the difficulty which frequently, and indeed very generally exists, of securing the blocks; thus avoiding all risk of their getting misplaced, or of any accident which might occur by their getting off, especially during sleep.

"The only teeth to which we can apply ligatures, are frequently so short, and of such shape, that it is impossible to secure blocks by ligatures alone, without carrying them so far under the gum as to do great mischief. We think that ligatures of any kind, and for any purpose as connected with teeth, should always be avoided when practicable. Another important object is also gained by this arrangement; that of enabling the patient to remove them at will, for the purpose of cleansing the mouth and teeth; and the operator to make any necessary alteration.

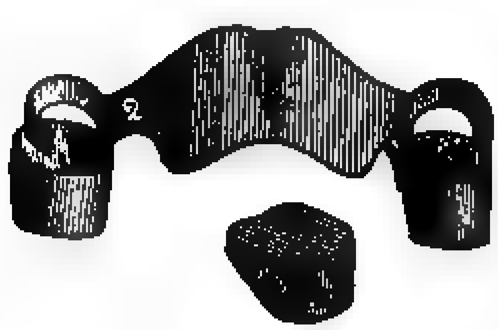


Fig. 16.—Apparatus of Westcott to "correct protrusion of the under jaw," 1844.

Fig. 17.—Chin Cap as devised by Westcott in 1844.

"This apparatus is represented in Fig. 16. The fixture being thus prepared, and adjusted to its place, the bandages are next applied. These are represented in Fig. 17 as also the contour of the face after the operation was completed.

"As the whole pressure from both bandages comes upon the chin, great care should be taken in adopting a pad for it, which shall be both easy and firm, before the bandages are applied. Pads should also be applied to all points where the bandages produce any irritation.

"After this object is, to some extent, attained, the tension of the oblique strap may be gradually increased. It will be perceived, moreover, that the blocks should be placed as far back as possible, for we thus augment the lever power by increasing the length of the long arm, or the space between the fulcrum, or block, and the point at which the power is applied, viz., the end of the chin, and at the same time equally diminish the short arm, or the space between the block and joint of the jaw. The bandages should be removed each day, and the mouth thoroughly cleansed and the face, particularly about the joint of the jaw, rubbed with some

mild liniment. The camphorated liniment, made by dissolving camphor in sweet oil, is perhaps as good as any that can be recommended.

"We now altered the blocks in two very important particulars. They were at first of equal thickness from end to end. This shape was changed by filing them nearly to an edge, from front backwards, making them wedge form, with the base looking forward. (See Fig. 16.) This constituted an inclined plane, so that the tendency of the pressure, made directly upwards, was to throw the under jaw back.

"If this irregularity should be considerable, so as to interfere with the main operation, we advise that two separate operations be made of it; first, for the correction of the irregularity of the teeth, and afterwards for the protrusion of the jaw. But if only one or two of the upper teeth point farther in than the rest, the whole may be attempted at the same time. This may be easily accomplished without retarding the main operation, by soldering straps on to the plate at nearly right angles with it, passing round behind the teeth we wish to bring forward, like the lining or back of a plate tooth. This piece must come so far below the point of the tooth as to be caught by the under teeth. The lower extremity would at

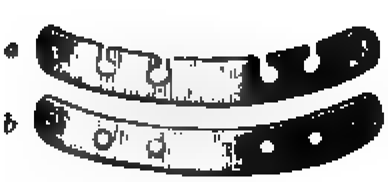


Fig. 18.—J. H. McQuillen

Fig. 19.—J. H. McQuillen.

first require bending forward, so as to shut outside the lower incisors, and so that they will exert due pressure upon it when the mouth is as nearly closed as it may be while the blocks are in their place. By straightening this standard slightly each day, as the tooth yields, we, as a general rule, correct any irregularity of the teeth as soon as the general object is accomplished or the jaw is brought into its proper position.

"If the lower point of this gold strap or standard should make undue pressure upon the under tooth or teeth on which it rests, the lower extremity may be widened to any extent, even so as to include every under tooth."

J. H. McQuillen. In the *Dental Cosmos* for November, 1859, Dr. McQuillen describes a case which came under his treatment.

Dr. McQuillen alludes to the fact that irregularity may be either congenital or acquired. The first was frequently due to hereditary transmissions; and the latter in the majority of cases, to premature extraction of the deciduous teeth,

though recognizing at the same time, other influences as prolific causes. Of the congenital origin, abnormally small maxillæ are frequent accompaniments and causes. "The most difficult and complicated case that could be presented to the practitioner for treatment is one in which the superior maxilla is unusually small; the alveolar arch contracted; the inferior maxilla preternaturally large, with the lower teeth outside of the upper, and the osseous tissue more dense and unyielding than ordinary."

Of his own practice, in former years, he had been in the habit of employing silk ligatures, thrown around the necks of the teeth and tied to the old-fashioned bar passing in front of them. The bar similar to Fig. 18*b* can be made of gold or silver, and is perforated at certain points with holes which, when it is adjusted, should be opposite the teeth to be acted upon. The silk ligatures are passed

Fig. 20.—Dr. C. A. Kingsbury.

through these holes preparatory to being tied. This plan is a very slow and unsatisfactory one, and after trying it for some time he had abandoned it altogether, substituting in its place, within the last three years, a modification of the same, made by passing a thin, flat file through the bar from above downward to the holes cut in it, thus forming an apparatus such as Fig. 18*a*. In lieu of silk ligatures he also employs India-rubber rings, cut from very small French tubing. When applying this arrangement, as the rings are so small that it would be a difficult and clumsy mode of procedure to stretch them with the fingers, he uses right and left curved approximal burnishers for that purpose; passing each of these inside of the ring and drawing them apart, the rubber is extended, and with facility slipped over the crowns of the teeth to be regulated. Having accomplished this, the

bar is placed and retained in position by passing one of the burnishers under the rings and drawing them forward and carrying each through the openings made by the file. A number of teeth can be acted on in this way at the same time; and as the fixture is easy of application, the patient or guardians may readily assist the operator by renewing the rings every day or two.

"In conclusion he would direct attention to the model in his hand, Fig. 19, in which it will be observed the right superior central incisor is considerably outside of the arch.

"This was accomplished by throwing an India-rubber ring around the incisor, and then stretching it over the crown of the first bicuspid of the same side. The contraction of the rubber in a few days drew it into place. To prevent the front teeth from striking during this period, silver caps were placed on the molars."

C. A. Kingsbury, in the same journal, p. 185, says, "The principal causes of irregularity of the teeth, as already stated, are hereditary and mechanical. I have met with a number of cases in my practice, where irregularity caused by a contracted alveolar arch existed in nearly every member of the same family, the predisposition being inherited from the mother. Within a few months past I have treated three cases within the same family. These cases, though quite different in form, and by no means equally bad, were all caused by malformation of the superior maxilla, of a congenital character, the impression being received from the maternal side.

"My method of treating such cases may differ in some respects from that of other members of the profession. When it is necessary to extract one or two bicuspid teeth to make room to bring the protruding cuspidati into their proper position, I invariably extract the second bicuspids unless the first are in a carious condition, or when being sound, they approximate so as to touch the lateral incisors. In such cases I extract the first instead of the second bicuspids.

"I take an accurate impression of the mouth, and fit a plate with as much care as if it were for an artificial denture, letting the plate for the superior teeth extend well back over the palatine surface, but not so far as to annoy the patient.

"I attach clasp and braces for the double purpose of firmly supporting the plate and preventing those teeth that are in proper position from being moved. If the occlusion is such that the inferior incisors, as is often the case, interfere with the regulation of the irregular teeth, I cap a molar on each side. I then, supposing the case to be one where the cuspidati stand outside of the regular curve of the superior maxilla, attach a small loop or ring of No. 20 wire to the palatine surface of the plate, at such point as the relative position of the teeth to be treated may indicate.

"By means of a gold spiral spring rather shorter than the distance between this ring and the tooth to be moved, one end of which is secured to the tooth by a silk ligature, and the other drawn back and hooked into the ring, a degree and kind of traction may be applied, best adapted to effect the desired object. A small strip of good gum elastic may be substituted for the spiral spring. But there is the disadvantage of its soon losing its elasticity and requiring frequent removal.

"The gum elastic rings made from tubing, so highly spoken of by some, have

never yet served me any good purpose. I have always found them to lack the elasticity and toughness of the ordinary dark-colored gum.

"In those cases where the superior incisors incline inward toward the palatine arch, and strike inside of the inferior, I resort to a device somewhat different from any that I have ever known to be used or described by any member of the profession. It may not, however, be new to others.

"Instead of applying a metallic bar upon the labial surface of the teeth, attaching its extremities by ligatures to the molars or bicuspids, as recommended by Fox and in frequent use by dentists, and then by means of ligatures passed around the teeth and fastened to this bar, drawing them into the desired positions, I adopt a very simple but most efficient appliance for accomplishing the same object. To such a plate as I have already described, I solder as many tubes or hollow cylinders as there are teeth to be regulated.

"These tubes are from four to five lines in length, and one and a half lines in diameter. Perhaps I can convey a more accurate idea, in the absence of a drawing, by their resemblance to an ordinary percussion cap, being open at one end, but rather longer, and of smaller diameter.

"These tubes are soldered to the plate with the open end facing the lingual surface of the teeth to be moved, and distant from them about two lines. Into these tubes are fitted small solid cylinders of wood, which serve as spurs to press upon the teeth. When applied, a small piece of ordinary gum elastic is put into the tubes, filling half their length. The small cylinders or spurs of wood are now inserted, so that when the fixture is adopted to the mouth, one end presses upon the gum-elastic, and the other upon the tooth, thus producing a uniform and persistent pressure.

"When a tooth requires to be turned upon its axis—as is often the case with the superior central incisors when they assume an oblique or diagonal position upon the alveolar arch—I attach a gold band to the tooth, so as to embrace it firmly. To this band on that side which is nearest the alveolar border, I attach a strip of gold, of such thickness and width as form an elastic spring, and long enough to reach to the first and second molars, to one of which the end of this is secured by a ligature.

"By this means a force is constantly applied in the direction I wish to move the tooth.

"Recently I have used the tube and cylinder wood to remedy this form of irregularity with so much success, that I am inclined to think they will entirely supersede the other appliance in my practice. While the spur of wood presses upon one side of the tooth to force it into its proper position, the other side is drawn in toward the plate or prevented from being moved anteriorly, as the case may require, by a ligature from that side to the gum plate."

(To be continued.)

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

JAMES DAVID McCOY, D.D.S., EDITOR
LOS ANGELES, CALIF.

FRACTURES OF THE MANDIBLE

BY W. A. WILKINS, M.D.C.M., MONTREAL, CANADA.

Roentgenologist, Montreal General Hospital; Demonstrator of Roentgenology, McGill University; late Associate Roentgenologist, No. 3 Canadian General Hospital, British Expeditionary Force, France; Consulting Roentgenologist, "A" Unit, Canadian Hospitals Commissions.

ONE of my reasons for discussing such an elementary subject as fractures of the mandible is that it is elementary. In recent years, so many advances have been made in diagnosis and in treatment of more important subjects that reference is seldom made to less important ones. The very greatness of the strides which have been made merely serves to widen the breach, and render us liable to neglect the ordinary and commonplace. One hesitates to bring up old subjects; but I am of the opinion that no harm can result, and some good may come, if from time to time, we refresh our minds on subjects which are elementary. It is with this object in view that I write and not with the belief that I will be able to throw new light on an old matter. Moreover, fractures of the lower jaw are sufficiently common in hospital practice to merit an occasional word. They constitute approximately two per cent of all fractures coming to the x-ray department of the Montreal General Hospital. They are of special interest to the orthodontist, and, in fact, the keen interest, which the members of the dental department of our hospital have taken in these cases, has suggested the subject to me.

It is not my intention to speak about the treatment: but to restrict my remarks to the different varieties of fracture occurring in this bone, and to the diagnosis in general, illustrating with skiagrams of cases from our department; and endeavor to emphasize the aid that the roentgen examination can be in diagnosis, in indicating the line of treatment to be followed, or in observing the effect of the treatment adopted, and the results of Nature's effort to repair the injury.

Although the diagnosis, as a rule, is easily made without resorting to a roentgen examination, nevertheless, now and again, cases occur in which the diagnosis is made by it alone, especially is this the case in the rare condition of incomplete fracture. This occasional finding is by no means its only value. Its greatest value consists in "visualizing" the line of fracture on the x-ray plate, giving definite information concerning the extent of the fracture and the position of the fragments. It should be remembered, that a single x-ray plate

is merely a shadow in one plane, furnishing information concerning two dimensions; namely, length and breadth. By making a second plate at right angle to the first, another point of view is obtained, and the third dimension can be constructed. This method is seldom practicable in injuries of the jaw, but fortunately the stereoscopic method is available and the results obtained are all that could be desired. The line of fracture, the degree of separation, or displacement of the fragments can be ascertained readily. Films placed inside the

Fig. 1.

mouth, owing to their small size, convey little information concerning the fracture, but are invaluable when it is desired to know the condition of an individual tooth or of the bone in its immediate neighborhood. As a matter of practice, the placing of a film inside the mouth in a case of fracture of the jaw is a difficult proceeding. Frequently a tooth adjacent to the fracture is loosened, and often there is comminution of bone in this region. Small isolated fragments may remain for months, acting as foreign bodies and causing a slight discharge until

expelled or removed. In such cases, a small film may succeed in localizing the spot where a plate may fail. In Fig. 1, three small fragments can be seen behind the last molar tooth. Although a difficult area for a film, these fragments were seen much better on a film made at the same examination. This case is the same as Fig. 17, but made one month earlier.

It is readily understood how the exposed and unprotected position of the lower jaw renders it very liable to injury, and consequently it is more frequently fractured than any other bone of the face, except the nose. The force and

Fig. 2.

direction of the blow will largely determine the seat of the fracture, and there is another predisposing cause which has not received the attenton it deserves; namely, conditions within the mouth at the time the injury is received. Foreign bodies between the teeth, such as a pipe, unquestionably affect the distribution of the force of the violence, fracture occurring at some point where the teeth are not in contact. Again, I have been impressed with the frequency with which fracture occurs in regions where the teeth are absent, and, therefore,

where the jaw is weakest. Fig. 2 is an example of this— a vertical fracture in an almost toothless jaw. The presence or absence of muscular contraction will also assist in determining the seat of fracture. A blow upon the jaw when the teeth are clinched is more likely to fracture the jaw at the point where the violence was applied—other things being equal—whereas, if the muscles are relaxed, or the mouth open, fracture of the base of the skull may occur.

Fracture from direct violence is the rule, the break occurring at the point where the force was applied. It may also result from indirect violence, as,

Fig. 3

fracture of the condyle from a blow or fall upon the chin. Owing to occupation and habits, the jaw is more frequently fractured in males than in females. Age is a predisposing cause, and although the commonest period in my series was around 35 years, it is by no means unknown in childhood or old age. More than 90 per cent of my cases occurred between the ages of 18 and 45.

The situation of the fracture may be in the body, the ramus, or in the condyloid or coronoid processes. The commonest situation is in the body, and if

Fig. 4.

Fig. 5

Fig. 6.

Fig. 7.

we exclude fractures of the alveolar border, such as occur during extraction, the favorite site is anteriorly, in the neighborhood of the canine tooth, the mental foramen or near the symphysis. It is also of common occurrence posteriorly, either through the angle of the jaw, or in the region of the last molar tooth. Fig. 3 is an example of a more or less vertical fracture just behind the mental foramen, and Fig. 4, just in front. Practically no separation is present. In Figs. 5, 6, and 7, the line of fracture is more anterior, and, in all three, the separation and displacement is the same, the anterior fragment being drawn

Fig. 8.

downward by the action of the geniohyoid, and geniohyoglossus, and the digastric. The first occurred in a child of 8 years, the second in a young man of 21, and the third in a youth of 18. An interesting side issue in these three cases is a comparison of the molar teeth. Fig. 8 is the same case as Fig. 5, two months later. The treatment has had little effect in correcting the deformity, but the callus which has been thrown out has bridged over the gap and rounded off the irregularity of the inferior border. Fig. 9 is a vertical fracture near the symphysis, reduced and held in place by a wire splint attached to the teeth.

In Figs. 10 and 11, the fracture line is behind the last molar tooth, vertical in the former and oblique in the latter. In both, the displacement is slight due to the action of the internal pterygoid and masseter muscles.

Fracture of the ramus alone is of far less frequent occurrence; of either the condyloid or coronoid processes, rare, and when present is generally found associated with fracture of some other bone of the face.

Regarding the direction of the line of fracture, the greatest number are

Fig 9.

oblique, no matter where situated; many are vertical, and very few are transverse. No one type can be assigned to any one region, and, as a matter of fact, it is not essential. Roughly, one may say that the majority at the angle are oblique; in the middle of the body, vertical; and in the anterior portion, vertical or oblique. In the ramus they are generally oblique, but may be vertical or even transverse.

The displacement of the fragments may be upward or downward, backward, or forward, internal or external, or a mere separation with a gap

Fig. 10.

Fig. 11.

between the fragments. Generally there is a combination present. Displacement, as a rule, is more marked anteriorly, the difference in the level of the teeth being evident. The anterior fragment is drawn downward by the digastric, the geniohyoid and geniohyoglossus. Nearer the middle of the bone, the posterior fragment will be drawn upward by the action of the temporal muscle. At or near the angle, displacement is not the rule, owing to the action of the masseter and internal pterygoid muscles. If the fracture is through the neck of the condyle, the condyle will be drawn inward owing to the internal attachment of the external pterygoid. In this case, the chin points to the injured side.

Fig. 12.

In about two-thirds of the cases, the fracture is single; in the remaining one-third, the break may occur in two or more places. In the latter condition, it more than twice as often involves both sides, and the situation may be the same on each side. Multiple fractures on the same side only, are less frequent. Fig. 12 is an example of a double fracture involving both jaws. In one jaw, the fracture is oblique and near the middle line; in the other, it is through the ramus and more or less vertical—an unusual type for this region. In neither case is there much separation of the fragments. In Fig. 13, one fracture is vertical in the region of the canine tooth, and oblique through the angle of the

Fig. 13.

Fig. 14

Fig. 15.

Fig. 16.

opposite side, with very marked separaton. Fig. 14 illustrates a fracture through both jaws at the same level. Note the denture in the upper jaw, and the scarcity of teeth in the lower. This, no doubt, was a predisposing cause to fracture. Fig. 15 is an oblique view of an interesting case. Two fractures of the lower jaw are present, namely, vertical in front of the third molar—where the teeth are absent—and oblique near the symphysis. The upper and lower jaws are held together by means of a wire splint. A third fracture through the zygomatic process can be seen.

Comminuted fractures are regarded as being rare, except when result-

Fig. 17.

ing from severe crushing or gunshot injuries. This has not been my experience, for on the x-ray plate, many of the apparently simple fractures show small fragments of bone at either end of the fracture line. Fortunately these small fragments seldom give rise to trouble. Fig. 16, illustrates a comminuted fracture in front of the third molar tooth, with great separation and displacement of the fragments. Several loose fragments can be seen, two of which are large. The position of the third molar appears to be very insecure. Note again, the absence of teeth in the region of the fracture. Fig. 17 is a war injury. The bullet fractured both mandibles at the angle, only one of which

is shown in this view. This one is the wound of exit, and there has been a considerable loss of bone substance. There was marked comminution, and small fragments of bone were discharged for several months. This skiagram was made six months after the injury was received. Although there is loss of substance in the region of the last tooth, the tooth is not loose. Note the contact between the third and first molars, the second having been extracted many years previously. Figs. 18 and 19 are also skiagrams of another war injury,

Fig. 18.

being anteroposterior and lateral views of the same patient. The jaw has been fractured by a piece of shrapnel which has lodged in the cheek in the neighborhood of the third molar, where it can be felt. Considerable loss of substance has occurred, osteomyelitis is present and the loosened stump of the canine tooth as well as several loose fragments of bone can be made out. Two more very small pieces of shrapnel can be seen, one in the right cheek and the other

over the right frontal sinus. The fillings in the teeth must not be mistaken for shrapnel.

Compound fractures are very common, usually opening into the mouth, as a result of which they become septic. Less frequently, they open externally, due to the violence of the blow splitting open the soft tissues overlying the bone. Occasionally they are compound externally and internally. Incomplete fracture, apart from the alveolar border, is rare.

Fig. 19.

Although the x-ray examination is positive, and, in all cases, the final court of appeal during the lifetime of the patient; nevertheless, to yield to the temptation of utilizing this short cut to diagnosis as the only means of examination, eventually would be disastrous. The clinical signs and symptoms cannot be ignored. Deformity at the seat of the injury, abnormal mobility between the fragments, irregularity of the teeth, crepitus, pain increased by the movements of the jaw, and hemorrhage are the immediate signs. Swelling, internally and

externally, appears very quickly. The flow of saliva is not only increased, but swallowing is so difficult and painful that dribbling occurs. If compound internally, as is so frequently the case, suppuration more or less severe intervenes, the breath becomes very foul, and within a few days the glands of the neck enlarge.

The prognosis in fracture of the mandible is generally favorable. Union occurs within four to six weeks in uncomplicated cases. Failure of union is rare, unless there has been a considerable loss of bone substance. Danger to life is slight, unless injury to the brain results from the violence of the blow, or infection becomes beyond control. Persistence of a sinus usually means the presence of a small fragment—large fragments generally cause profuse discharge. To quote from Stimson, the probabilities are, "that union will take place promptly; that no serious complications will arise; and that no important deformity or disability will remain."

The question of treatment, I will leave for more capable hands. My prime object is an endeavor to illustrate the value that an x-ray examination can be in fractures of the mandible. It gives information, which, for exactness, can be exceeded only by the postmortem table. Fortunately the x-ray examination is part of the routine examination today for all fractures; and I do not imagine that any case of fracture of the mandible occurring within reach of an x-ray installation, escapes examination.

The International Journal of Orthodontia

PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 801-807 Metropolitan Bldg., St. Louis, Mo.

Foreign Depots—*Great Britain*—Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

Subscription Rates—Single Copies, 30 cents. To anywhere in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $3.00 per year in advance. Under foreign postage, $3.40. English price: 15/ per annum, 1/6 per number. Volume begins with January and ends with December of each year.

Remittances—Remittances for subscriptions should be made by check, draft, postoffice or express money order, or registered letter, payable to the publishers, The C. V. Mosby Company.

Contributions—The editor will be pleased to consider the publication of original communications of merit on orthodontic and allied subjects, which must be contributed solely to this journal.

Opinions—Neither the editor nor the publisher hold themselves responsible for the opinions of contributors, nor are they responsible for other than editorial statements.

Reprints—Since it is not desirable to hold type standing longer than absolutely necessary, all requests for reprints should be made at time of submitting manuscript for publication. Rate card will be sent with galley proof.

Communications—Contributed articles, illustrations, letters, books for review, and all other matter pertaining to the editorial department should be addressed to the Editor, Doctor Martin Dewey, 25 East Washington Street, Chicago, Ill. All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 801-807 Metropolitan Building, St. Louis, Mo.

Illustrations—Such halftones and zinc etchings as in the judgment of the editor are necessary to illustrate articles will be furnished when photographs or drawings are supplied by the authors of said articles.

Advertisements—Objectionable advertisements will not be accepted for publication in this journal. Forms close first of month preceding date of issue. Advertising rates and sizes on application.

Change of Address—The publishers should be advised of change of subscriber's address about fifteen days before date of issue, with both new and old addresses given.

Nonreceipt of Copies—Complaints for nonreceipt of copies or requests for extra numbers must be received on or before the fifteenth of the month of publication; otherwise the supply is apt to be exhausted.

Entered at the Post Office at St. Louis, Mo., as Second-Class Matter

EDITORIALS

Post-Graduate Courses in Dentistry at State Meetings

NOW that the time is approaching for state dental societies to hold their annual meetings, the post-graduate course is much in evidence.

There is much to be commended in this; and if the work undertaken is well planned and systematically carried out, great good comes to those who take the courses. Dental education is making such rapid and gigantic strides that one must be constantly on the alert for self-improvement, or be hopelessly relegated to the rear. The dentist who graduated ten or twelve years ago is at a disadvantage when compared with the graduate of today, and unless the graduate of former years bestirs himself, and by frequent post-graduate courses and special work, keeps abreast with the mental life of his profession, his position will soon be an uneviable one.

Problems fraught with vital interest to the dentist are crowding hard upon his time for settlement. How best to fill root canals; how to read and inter-

pret dental radiographs; how to select and apply the best in mechanical dentistry, and at the same time know and understand physiological chemistry, physical diagnosis, and the factors entering into the cause of malocclusions; the best method for treating such conditions; these are some of the varied and far reaching problems that the dentist is called upon to solve.

Reading is undoubtedly the most universal method for obtaining knowledge, but reading *per se* is not the most efficient method to advance oneself mentally. Reading, observation, reflection, and practice, aided by the personal touch of the teacher, is undoubtedly the most efficient method in making mental progress; and of these four methods, the personal touch of the teacher is one of the most valuable. One reads, reflects, and puts into practical application what one learns from the textbook or the journal article, but still there hangs over one the air of uncertainty. But, let the teacher once point out the way, and everything is made clear. There is a power that goes with the spoken word that is lacking in the written page. The teacher clinches the point, drives home the argument, and so convinces, that one is able to more aptly apply information gained in this manner than in any other.

Another point in favor of the state post-graduate course is its cheapness. Where can a dentist take a course or get even one lecture on a special subject from an authoritative source for ten dollars? It cannot be done, but you can contribute this amount to the general fund that your state society is raising for this purpose and for four days you can enjoy a mental treat that will clear the cobwebs out of your brain and set your feet on solid rocks.

A state post-graduate course in dentistry is a great thing. It is a vast improvement over the old time state dental meeting dominated by the politicians of the state society that usually evolved itself into a mutual admiration society with little or no scientific value to it. The idea of two or more states uniting in this work is to be commended. Better and more talent can be secured in this manner, and a wider range of opinions can be centered upon the scientific problems in which the dentists are so vitally interested.

Blind Leaders of the Blind

ONE of the strongest and most suggestive editorials that has been published in a dental journal in many years appeared in the January, 1917, issue of *Oral Hygiene*. One is not given to expect great things editorially, from a journal of the *Oral Hygiene* type. But Jesus came out of the despised Nazareth, and surprises in journalism, as well as in politics, are not impossible.

It is said that the President of the New York Central Railroad, when Elbert Hubbard's immortal "Message to Garcia" was given birth, procured and sent a copy of it with his compliments to every employee—big, little, old, and young—in the service of the road of which he was president.

It would be more than philanthropy, it would be real "Simon pure" service if a copy of "Blind Leaders of the Blind" could be engraved on never-eroding parchment and given to every practicing dentist, every dental teacher, and every dental student in the United States of America.

The reading and frequent re-reading of this editorial might be the needed stimulus to bring about higher education and better prepared recruits in the dental profession. When one realizes that he is ignorant and illiterate, this knowledge is a stimulus to study in an effort to overcome this weakness. The hopeless individual is the one who is ignorant, but at the same time is too ignorant to realize it.

The person upon whose ears the message in "Blind Leaders of the Blind" should strike in thundering tones is the man who conducts the commercialized dental school, who cares nothing about the fitness of the matriculate to take up a professional career, and who looks upon the dentist as nothing more than a de luxe edition of the village plumber. To such an individual, the editorial "Blind Leaders of the Blind" should be repeated with all the solemnity of the Lord's Prayer, and it should be repeated morning, noon, and night until his craven soul sees the light of a great truth, and is born again.

Is it any wonder that the dental profession stands at the bottom in the list of the learned professions when one takes cognizance of the fact that no effort was made, until a few years ago, to select the material that made up its recruits, and that its leaders then were men with little or no special training in the work which they sought to perform?

Someone said, somewhere, sometime, that the dead past should bury its dead. Realizing that this is not bad philosophy, one is prone to draw the veil upon the mistakes and the short comings of dental teachings so prevalent in the past, but it is well in forgetting to look keenly into the future.

Why should the blind continue to lead the blind? Why should the unfit dental school continue to graduate the unfit, thus increasing their spawn to in turn reproduce more of their kind? Why not get leaders whose sight is unlimited and who are capable of a clear vision into the realm of science? There is not a state university in America but that is capable of maintaining a well equipped and well manned dental department with teachers who are not blind, who have more than a grammar school education, and who are capable of training dental students in such a manner that when they take upon themselves the duties of their profession they will reflect credit upon dental science and their Alma Mater.

Run such departments in close proximity to the medical departments of state universities in order that dental students may know and understand the intimate relationship between medicine and dentistry, thus narrowing the gulf between these two professions, and you will see, in time, a new order of things. You will see leaders spring up in dentistry with a clear vision, and you will see this great science come into its own, and bestow upon humanity the blessings of which it is capable.

The Open Door

ONE is quite apt to hear much said, and can read much that is written upon the democracy of science. We are told, and rightly so, that science recognizes no geographic boundaries, that the searcher for truth is glad to find it, in the workshops of either friend or foe.

Such a premise as the above can be rightfully applied to the genuine seeker for knowledge, but to the poser and the pseudoscientist this statement has little meaning. Truth is the common property of all, and he who seeks to hide its light from the world for personal gain is an enemy to progress, and a menace to the cause he has espoused.

It is said of liberty that many crimes have been committed in its name. The same is equally true of science. Behold the self-appointed gods in some of the many fields of human endeavor, blowing the trumpet of accomplishment, and expecting to see the servient knee of all its devotees bend to the ground; and unless the bending is in evidence, the fires of wrath are kindled and the unholy ones must be cast out into eternal darkness where, figuratively speaking, there is weeping and gnashing of teeth.

Such an attitude on the part of men is cause enough to elicit genuine pity for them. Pity that they are so far away from the goal they hope to reach, and pity that they can do damage to some with whom they are thrown in contact. Men of this type are known to all, and unfortunately they grace—more correctly speaking, disgrace—both the dental and the medical professions. The "holier than thou" attitude is assumed by them, and he who has the temerity to disagree with their conclusions in the realm of science is in danger of being crushed. This attitude is wrong, and no genuine scientist ever assumes it. Truth is big enough to encompass all. The man who genuinely seeks it has no time to waste in condemning the efforts of his fellow workers.

There is plenty of room in the realm of science for all, but there is no place in this realm for the individual who wants to usurp authority, decry the efforts of his co-workers, and stigmatize the results that others have secured through arduous toil.

There is too much to accomplish in dentistry and medicine to waste one's time and energy trying to placate, understand, or affiliate with the type that we have described. Like the biblical poor, they will always be with us. Let them bay at the moon, while the tried and genuine disciples of truth continue in their endeavor to open wider and still wider the door.

News and Notes

Dr. Robert W. Gaston announces the location of his offices at 1137 Maison Blanche Building, New Orleans, La., for the practice of orthodontia exclusively.

Dr. Rolof B. Stanley has removed his office to 8 East Fifty-fourth Street, New York City, for the exclusive practice of orthodontia.

Dr. John Lockhart Dudley announces his location in Buffalo at 722 Main Street, Ansonia Building, for the exclusive practice of orthodontia.

Dr. Walter Hyde, graduate of the School of Orthodontia of the Forsyth Infirmary for Children, announces the opening of his office at 603 Physicians and Surgeons Building, Minneapolis, Minn. Practice limited to orthodontia.

The Fifty-third Annual Meeting of the Massachusetts State Dental Society will be held on May 3, 4, and 5, 1917, at Springfield, Mass. J. Arthur Furbish, D.M.D., 400 Marlborough St., Boston, Mass., is the secretary.

Dr. Martin Dewey has announced his new location at 25 E. Washington St., Chicago, Ill. Orthodontia exclusively.

Brophy's New Book on Oral Surgery*

IT has been several years since there has been a contribution to dental literature of as much importance as Brophy's "Oral Surgery." There probably is no man in the dental profession as well fitted as is Dr. Brophy to write upon this subject. Long years of experience have enabled him to collect a wealth of data from interesting cases in practice which he has been able to use in the preparation of this work. Brophy's book is divided into two parts, the first of which deals with the principles of surgery, while the second is devoted to diseases, injuries, and abnormalities of the oral cavity and associated parts. In the first part, we have a general review of pathological conditions and diseases which affect the oral cavity: this necessarily is of interest to anyone who is interested in oral deformities. The second part deals with diseases and injuries, and the manner of treating them, and is especially interesting, as it contains, in detail, Dr. Brophy's technic of the operation for harelip and cleft palate; in fact, the entire surgery of the head and face is considered. The book is profusely illustrated, most of the illustrations having been made especially for this work. The close interest which exists between oral surgery and orthodontia makes Dr. Brophy's book a particularly valuable addition to the library of anyone practicing orthodontia.

*A Treatise on the surgical diseases, injuries and deformities of the mouth and associated parts. By Truman W. Brophy, M.D., D.D.S., LL.D., President and Professor of Oral Surgery and Dean of the Faculty, Chicago College of Dental Surgery. With special chapters by Matthew H. Cryer, M.D., G. Hudson-Makuen, M.D., William J. Younger, M.D., F. W. Belknap, M.D., Calvin S. Case, M.D., D.D.S. 909 Illustrations including 39 plates in colors. Octavo: 1106 pages. Cloth, $10.00.

Dr. James Grant Lane.

The International Journal of Orthodontia

Editor: Martin Dewey, D.D.S., M.D.

VOL. III | ST. LOUIS, APRIL, 1917 | NO. 4

ORIGINAL ARTICLES

BAND AND LINGUAL ARCH TECHNIC*

BY JOHN V. MERSHON, D.D.S., PHILADELPHIA, PA.

From The Thomas W. Evans Museum and Dental Institute School of Dentistry University of Pennsylvania.

THE first step in the technic of band making as employed by the author consists of taking a modeling compound impression of the lateral half of the arches, using a half impression tray. The object in taking only a half impression of the arch, or an impression of the molars and premolars of one side only, is to avoid the dragging of the impression as so often occurs if both sides are taken at once. In taking this impression, a half impression tray as used in ordinary crown and bridge-work can be employed, or an entire tray with modeling compound only in one side may be employed. The impression is removed from the teeth parallel with the long axes of the teeth to avoid as much distortion as possible, and to give as good an impression of the occlusal surface of the teeth and the gingival marginal ridge, including the buccal and lingual embrasures, as is possible to secure.

From such an impression a model is made as shown in Fig. 1. The band is then made over this model after the model has been prepared as is shown in Fig. 2. The preparation of the model consists in taking a fine ribbon saw and cutting through the surfaces of the teeth on the mesial and distal sides of the tooth which is to be banded. This cut with the ribbon saw is made a considerable distance below the gingival margin of the tooth as is shown in Figs. 2 and 3 in order to expose the full gingival margin of the tooth for the making of the band. The gingival margin of the tooth is curved to represent the natural curvature of the tooth in the mouth.

After the model has been prepared as shown in Figs. 1 and 2, a wire measurement is then made by taking a fine piece of wire, holding the end of it

*Principal part of an address delivered before the Alumni Society of the Dewey School of Orthodontia, Chicago, March 13, 14, 15, and 16, 1917. Written from notes made by Martin Dewey, D.D.S., while observing Dr. Mershon work in his office.

in a broach holder, and twisting it around the tooth. This wire measurement is made at the greatest circumference of the tooth, and is twisted very tight upon the plaster tooth. After twisting tight, a pull is made on the ends, and an extra twist made. The plan of making the bands from this point will be to do everything which will have a tendency to make a band slightly smaller than the natural tooth. The wire measure is then removed from the tooth intact, or can be cut on the lingual side before it is removed and straightened out as shown in Fig. 4. This wire measure is then laid upon a piece of band material the ends of which have been cut on a slant as shown in Fig. 5. The band material may be iridio-platinum, clasp metal, or Neyora elastic gold. If Neyora elastic gold or iridio-platinum is used, the band material is .005 inch thick and .18 inch wide. It will be observed in Fig. 5 that the piece of band material is slightly

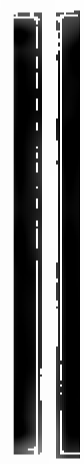


Fig. 1.

Fig. 2.

Fig. 3.

longer than the wire measure and should be made about .06 inch longer than the measure. A mark is made on the band material to represent the end of the wire measure. It will be seen from studying Fig. 5 that the long end of the beveled band material represents the measure of the tooth. In other words, when the band is soldered by overlapping the .06 inch which is longer than the wire measure, one edge of the band will be smaller than the wire measurement. Fig. 6 shows the manner in which the ends of the band are brought together and overlap. In making the solder joint, the band must be overlapped far enough to cover the mark on the band, for it must be remembered that this mark represents the end of the measuring wire; and if the mark is not covered, the band will be too large.

After the band is soldered, it will be found that it will not pass the greatest convexity of the tooth; because of the fact that the ends of the band were

cut on the bias the occlusal border is smaller than the gingival border. In fitting this band it then becomes necessary that the band be contoured and stretched in order to adapt it to the greatest circumference of the tooth, and in order to enable the band to slip gingivally past the greatest circumference. The band is placed over the tooth, and a careful note made of the portions that bind at the greatest convexity, then with stretching pliers modified by the author, as shown in Fig. 8, the band is stretched enough to allow it to slip down to the

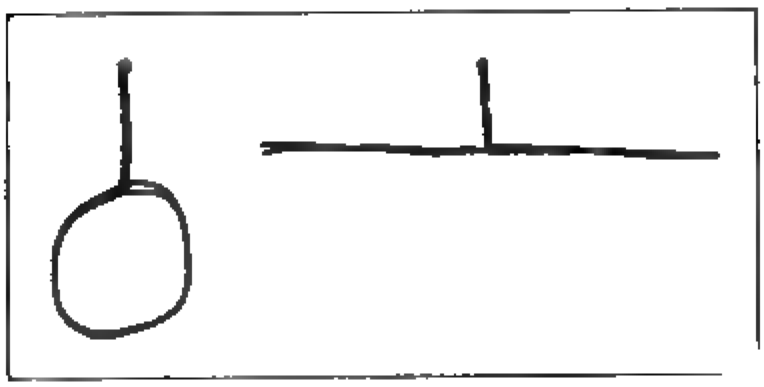


Fig. 4.

Fig. 5

Fig. 6.

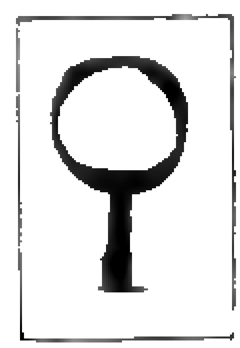


Fig. 7.

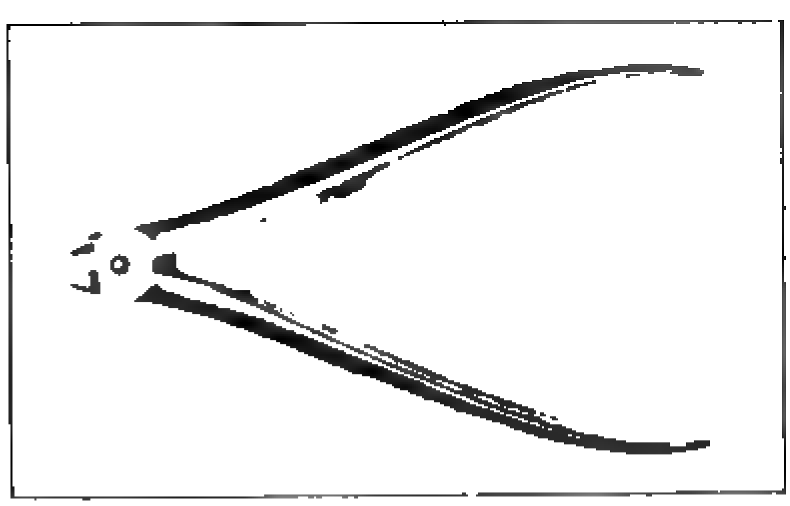


Fig. 8.

gingival portion. The mesial and distal gingival borders of the band are festooned in order to avoid infringement of the band on the gingival tissue. After the band is festooned, the smaller edge or top is carefully stretched until the band slips to the desired position on the plaster tooth. It is not expected that this band, fitted to the plaster tooth, will fit the natural tooth accurately, but it can be fitted so nearly perfect that it will require very little contouring and stretching to adapt and place it on the tooth in the mouth.

In placing these bands on the teeth, the soldered side is placed on the buccal side of the lower molar, and on the lingual side of the upper molar. The

reason for this is the buccal side of the lower molar presents a convexity at the gingival marginal ridge which is greater than that at the occlusal border. On the upper molars, the lingual side presents a greater convexity than the buccal side, therefore the lap is placed on the lingual side of the upper molar. A band that has been contoured and stretched and festooned after the manner described, if it is cut opposite the soldered seam and straightened out, will present an appearance as shown in Fig. 9.

The lower band must be stretched slightly in the lingual occlusal third. The upper molar band is soldered on the lingual side, the overlapped edge is stretched to fit the lingual convexity of the mesio-lingual cusp and the small fifth cusp which is found on the mesial side of the mesio-lingual cusp. After the band has been fitted, the buccal and lingual edges are bent toward the center of the tooth at the gingival border of the mesial and distal edge is festooned so as not to interfere with the proximal gum tissue.

Fig. 9.

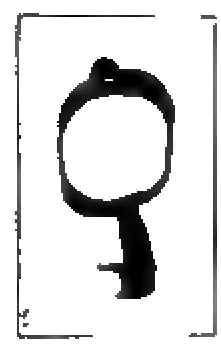


Fig. 10.

Fig. 11.

The half round tube, as shown in Fig.10, which is about .10 inch in length, is soldered on the lingual side of the band to receive a half round spur, which is soldered to the lingual arch. The half round tube is soldered with the flat side to the band. These half round tubes may also be soldered on the buccal side of molar bands to be used to receive the attachment of the labial wire in the construction of the pin and tube appliance. The appearance of the band after the soldering of the tube on the lingual side is shown in Figs. 10, 11, and 12. Fig. 13 shows the occlusal view of the model of the lower teeth to which has been fitted two lower bands for technical demonstration which carry perpendicular half round tubes on the lingual side and which show the attached spur on the buccal side for the use of intermaxillary anchorage. After the tube has been soldered on the band, as shown in Fig. 13, the next step is the attachment of the half round spur to the premolar section of the lingual arch as

shown in Fig. 14. As has previously been stated, on the upper molars the seam of the band is made on the lingual side, which makes it necessary to have a half round tube in the proximity of the seam and in a great many instances directly over the seam. The soldering of a half round tube on the seam can be accomplished by using a lower carat solder than the one used for the seam. It must also be remembered that in making these attachments of the half round tube to the band they must be securely soldered to prevent them from being torn loose under the stress of mastication. In attaching a tube on the lingual surface of the upper molar band it must be placed as far gingivally as possible to avoid interference with occlusion when the lingual arch is in position. The tube on the lingual side of the lower molar, providing the molar teeth have the

Fig. 12.

Fig. 13.

Fig. 14.

proper bucco-lingual relation with each other, can be placed nearer the occlusal border than can the tube on the upper molar, owing to the fact that there is no chance for occlusion to interfere with the tube on the lingual side of the lower molar. In using half round perpendicular tubes on the buccal side of lower molars in the construction of a pin and tube appliance, it must be remembered that the buccal tube must be placed near the gingiva, for in this case it will interfere with the occlusion of the buccal cusps of the upper molars if placed close to the occlusal border.

After the bands have been made and the tubes attached, as shown in Figs. 11 and 12, the bands are then transferred to a full model of the teeth as shown in Fig. 13. A straight piece of 19 gauge wire should be used for the construction of the premolar section of the lingual arch, to which a half round

spur is soldered about .01 inch shorter than the half round tube to allow for the lock at the gingival end of the half round tube. This 19 gauge premolar section of the lingual arch is shown in Fig. 14 and also can be seen in Fig. 17.

Fig. 14 shows how the premolar sections are adapted to the teeth; on the right molar is shown the premolar section without the lock, while on the left molar is shown the locking device for holding the lingual arch in position. This locking device is a modification of what has been known as the Young-Angle

Fig. 15

lock, and is made by soldering a piece of small gauge wire to the lingual premolar section mesial to the half round spur. This lock should be credited to Young and has been known as the Young-Angle lock. The premolar portion of the lingual arch is made to follow the irregularities of the premolars in each case as can be seen by studying Fig. 14. After the premolar portion has been fitted, the ends are cut off at a point which, as a rule, is distal to the distal surface of the canine or about the center of the first premolar.

The central or incisal portion of the lingual arch is next to be fitted. The incisal portion is also fitted to the irregularities of the teeth as is shown in

Fig. 16.

Fig. 15. It is made of such a length that the ends of the incisal section will exactly touch and fit evenly the ends of the premolar sections as is shown in Fig. 16. The incisal section is fitted to the teeth to occupy the position slightly occlusal to the gingival marginal ridge. After the incisal section has been fitted to the irregularities of the teeth as shown in Fig. 16, the ends are so shaped that they meet end to end with the premolar section, the three sections are then soldered together with the appliance in position on the model. This

insures accuracy and ease in soldering. The object of making the lingual arch in three sections is, the individual sections can be more easily fitted and the ends better adapted than when an attempt is made to fit an entire arch into all of the irregularities and bring the right and left ends to the proper molar positions and get the proper alignment of the spurs without having a spring or "kick" somewhere in the lingual arch. The various sections of the lingual arch photographed separately are shown in Fig. 17. The small piece of wire in the center is the premolar section before the half round spur has been soldered to it. Fig. 18 shows the lingual arch, one side of which shows a locking device, and on the other side the locking device has not yet been soldered in place. Fig. 19 shows the completed lingual arch soldered together in position on the molar teeth. This lingual arch is then taken off of the model and the bands and arch can be placed upon the teeth in the mouth at one sitting.

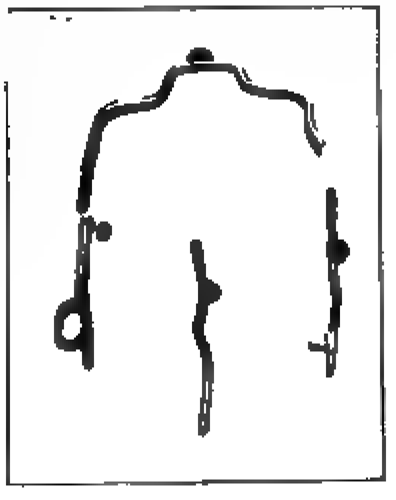


Fig. 17.

Fig. 18.

Fig. 19

An advantage in using this appliance is that only a small amount of space is taken up, and there is not the inconvenience to the patient that is experienced when the entire appliance is put on the teeth at once. The bands are placed on the teeth and the lingual arch is in position in a passive condition and is allowed to remain in a passive condition for a few days. When it is desired to increase the active pressure on the lingual arch or to increase force on the malposed teeth, the locks are carefully removed from the gingival portion of the half round tube, so that the lingual arch can be removed from the tube on the molar band without distortion. By using a pair of Hawley measuring calipers, as shown in Fig. 20, a measurement of the distance between the half round spurs

can be obtained after the manner shown in Fig. 21. After measuring the lingual arch as shown in Fig. 21, the points of the calipers are then set in a fixed position so as to record the distance between the perpendicular tubes on the molars at the time the arch was removed from the molar.

Force is applied to the malposed teeth by taking out some of the irregularities in the lingual arch with a pair of pliers, which increases the size of the lingual arch in the incisal region and exerts pressure upon the malposed teeth. By increasing the width of the incisal section, pressure is brought to bear directly upon the premolar section in the canine region, which has the effect of widening the canines and thereby making room for the malposed teeth

Fig. 20.

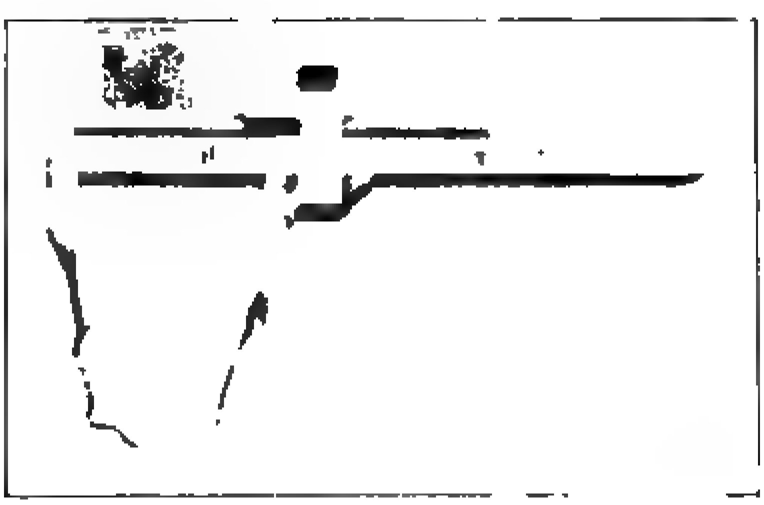


Fig. 21

to move into their proper position. After taking out the irregularities of the incisal section of the lingual arch and increasing the space between the canines, the molar half round spurs are then checked up by the use of the Hawley measuring calipers which were set at the time the lingual arch was taken out of the molar tubes. The calipers act as a guide in determining how much expansion has been placed in the molar region or how much the perpendicular spurs have been moved either in a buccal or lingual direction. By using such measurements with the Hawley calipers or a similar pair of calipers, it is possible to place the half round spurs back in the half round tubes with the same amount of spring as was present when they were taken out if it is desired. If it is desired to place an expansive force on the molars, the exact amount of expansion which is produced can be checked up by referring to the measurement as shown by the calipers, which was obtained when the lingual arch was taken out of the tubes. If it is desired to rotate the molars, this rotation can also be accomplished by changing the position which the half round spur bears to the half round tube by bending the arch in the premolar region. With the perpendicu-

lar tube it is also possible to tip the molars in any direcion desired or to produce a bodily movement. With the lingual arch the pressure exerted upon the teeth is always gentle, and owing to the fact that the arch is fitted to the lingual convexity of the incisors and placed occlusally to the gingival marginal ridge, if the pressure is too great, the 19 gauge arch will spring enough to relieve the pressure and thereby prevent the device making the teeth sore and still give the long range of elasticity which will allow the teeth to move for a considerable length of time. There is no style of appliance with which the author is familiar which has a greater range of elasticity, and at the same time a delicate pressure which is not sufficient to make the teeth sore and still produces physiological tooth movements.

Certain teeth require greater movement than others, as is shown in the left lateral incisors. After the dental arch has been expanded, a spring extension

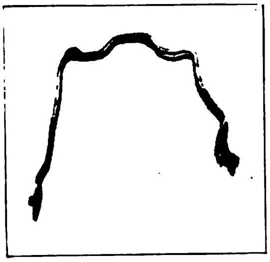


Fig. 22.

spur can be soldered to the arch as shown in Fig. 22, which will exert pressure on the lateral incisor for a considerable length of time without disturbing any of the other teeth. In the majority of cases the author places his extension spur on the gingival side of the lingual appliance. When this spur is first put on it raises the entire lingual appliance slightly occlusally, but there is an active force present which will bring the appliance back to its passive state and thereby produce movement of the teeth desired.

The modern tendency is for orthodontic patients to desire an appliance that is inconspicuous, one that does not interfere with speech, and one that can be kept clean. Of the large number of appliances that have been examined during the past few years which have been brought out in the practice of orthodontia, in the opinion of the author, the lingual arch, used under proper conditions and used with the proper understanding of mechanics, offers the most ideal appliance that has ever been devised.

FACIAL IMPRESSIONS AND CASTS

BY OREN A. OLIVER, D.D.S., COVINGTON, VA.

PART I.--THE PROFILE CAST

IN past years not enough attention has been given to the facial casts and impressions used in orthodontic cases. These plaster casts, made from plaster impressions, are about the only means by which the natural curves and facial lines can be reproduced in cases of imperfections of facial outlines or dento-facial deformations, caused by malposition of the teeth and jaws. It is almost necessary to have some way to study and compare the features during the progress of the operation, some way to follow up the different stages of the work, and to compare beginnings with results. For this purpose the facial photographs have been found very good, but do not begin to give the satisfaction that comes from facial casts, as these permit examination in detail from every angle. This article gives the general principals for making facial plaster impressions, but treats in detail of only the plaster profile cast.

These facial impressions can not be made by the first amateur that comes along, but require patience, practice, and to some extent, the skill of a mechanic. The condition of the patient has a great deal to do with the success of the operation. Especially if the subject is a child, it is necessary that the doctor gain his full confidence. No child will be willingly hurt, and until he is sure that the operation will last but a few minutes, and until he is positive that he will not be hurt, there is no use in expecting him to lie back quietly and be "plastered" without so much as changing his expression. It is better if all bystanders are sent out of the room, at least, out of the sight of the patient. These sympathizing mothers and solicitous fathers are all very well in their places, but when a child is the subject for a facial cast they are as much in the way as if the child were sitting for a photograph. If the patient once realizes that his expressions and emotions are of little or no consequence to the doctor, he is very likely to lose his selfconsciousness or fear and become perfectly at ease, and of course, the more natural the expression, the better will be the result. The patient should not be made to feel that he is about to undergo a serious operation, but let him understand that work is being done which is necessary to both him and to the doctor with no injury to either.

Now as concerns the work proper: The patient is told to relax in a comfortable position in the chair; or better still, if available, is laid on a table, in either case with his face turned from the operator. The operation is begun by taking a piece of soft lead wire, and starting at the occipital protuberance or the border of the hair, as preferred, then bringing it down in a vertical position across the forehead, nose, and chin to the neck, carefully working this wire to the curves of the profile, as shown in Fig. 1. When this is done the wire is removed without changing its form, and laid on a piece of not too brittle pasteboard. Enough pressure is put to bear on the wire that it leaves an indentation in the pasteboard like the profile of the patient. A pasteboard profile is obtained by cutting out along the indented line, fitting the cut to the face of the

model and being sure that its curves join the real ones correctly. (Fig. 2.) The reason for this is purely relative to the making of the profile cast. By using an obstruction of this kind there is little possibility of the plaster spreading beyond the median line of the face, and thus, though the construction causes

Fig. 1

Fig. 2

a little trouble, the pasteboard barrier facilitates the work of the operator by giving a clean cut profile, and prevents the annoyance to the patient of spreading plaster.

Next the face of the subject to the median line, or to the pasteboard obstruction is lathered with liquidized vaseline to act as a partition between the skin and the plaster and to enable an easy removal of the impression. This liquidation is accomplished by placing a thin glass jar of white vaseline in a bowl of warm water until soft enough for use. However, the vaseline must not be in a totally liquid state, but with body enough that a rapid coating may be put on the face with the aid of a shaving brush or some other large, soft brush. If the pasteboard division is not used, the vaseline is put on to the median line of the face and the doctor must be very careful not to let the plaster overstep its bounds. This vaseline painting should begin at the cheek, then extend to the mouth, lips and teeth if they are exposed. When the ear is reached a piece of cotton should be used to close the opening so that in no way will the ear drum be exposed to falling plaster, and the depressions and outer

Fig. 3

rim should be carefully painted with vaseline. The hair around the forehead and ears may be brushed back, but the artistic effect is increased by letting it fall naturally and covering it thoroughly with the grease in a more congealed state than is used on the skin. The details, such as the eyelids to the lashes, and the skin around the nostrils, should be given special attention and thoroughly gone over with the oily substance; the skin is especially tender in these places and the impression is not so easy to remove as on a smooth surface.

When the vaseline thoroughly fills every crack and crevice of the skin, the plaster is ready to be laid on. A fine grade of plaster, but one which does not harden too quickly, is best to use; and it should be mixed with water enough to make a smooth clinging substance which can be spread with a spatula and will not run off an inclined surface. The only tools necessary for the main work are a large bowl for the mixed plaster, a wide spatula, and a brush for all tiny crevices and depressions. The pasteboard form now comes into use and requires an assistant to hold it in place in order to give a clear profile. It is of great importance that the plaster be laid on rapidly enough not to congeal

in patches, but one bit must be smoothed into the next as in painting with water colors. As with the vaseline, the plaster should be laid on the cheek first, working upward toward the eye. When the coating is put underneath the eye the patient should look upward lest his lashes pick up some of the plaster and become hard and stiff with it. The mouth seems to be the critical point, as the patient unconsciously hardens the muscles to prepare for the shock of the plaster, and as the spatula passes near the lips it is very hard for him to prevent any twitching or changing of the expression. Here, especially, is where the doctor's tact is called forth. He must not annoy or attract the patient in any way that might cause motion or a change of facial lines. If the subject is at all under control, the best the operator can do is to work as quickly and deftly

Fig. 4.

as possible with the least noise or confusion Confusion on his part confuses the patient.

Two mixes of plaster usually suffice for a profile cast, though the work must be done rapidly lest it become too hard for handling. The thinnest coat should cover the nose while the hardest should be used for hair and eyebrows, as it is most easily removed. In the second coating, to strengthen the impression, a small amount of potassium sulphate added to the water can be used to reinforce it, as this hardens the plaster with great rapidity. (Fig. 3.) When the plaster is entirely hard, the impression should be raised gently from the face; but this should be done slowly and without exerting much force, lest the plaster crumble at the edges or some thin portion crack. The mixture may be

Fig. 5.

Fig. 6.

slightly adhered to the hair or eyebrows, and if the cast is removed too quickly the clinging hairs may cause the patient to move and spoil the cast. When it is being carefully removed, the finger or spatula may be inserted under the rim of the raised impression, pressed against the skin, and the hairs disengaged from the clinging substance without causing trouble either to the patient or the impression.

After the impression is taken from the face, it should be thoroughly dried before the varnish is brought into use. Shellac is employed for this purpose and a smooth coating should cover the entire impression. This must be dried; then with a camel's hair brush and some plaster and water, all the little air bubbles or other blemishes may be remedied. A second varnishing of shellac is then used to avoid the exposure of any plaster, and when this is thoroughly dry, a final painting of sandarac is applied.

When the last coating of varnish is dry, a thin plaster mixture should be poured into the impression, which is jarred slightly from side to side that the substance may work down into the crevices. A second mix of plaster is usually necessary to give the desired thickness, and this second batch is poured into the impression, smoothed down carefully and trimmed around the edges with the spatula. As it dries it may be scraped till all imperfections and rough edges are removed, giving a neat finish to the back.

The impression should then be turned to the other or front side, and with a sharp knife it should be marked into sections that facilitate the removal of the original plaster. (Fig. 4.) By cutting carefully but deeply to the division of varnish these parts may be more readily handled and more easily removed than by attempting to nick or hack off pieces haphazardly. The ear with its rims and depressions demands special attention as a little negligence may result in a chipped model. After all the sections have been removed, a plaster knife and careful trimming will bring out the profile intact and clear cut. By again using the camel's hair brush, dry plaster and a little water, all surface scars, and blemishes may be made smooth. (Fig. 5.)

The cast is now completed with the exception of the corks placed in the back of the model to be used as a means of suspension by wires. (Fig. 6.) These corks may be held in place by inserting them in holes cut in the plaster, and then filling the back of the cast with plaster even to the tops of the corks; and when this is smooth and hard, the facial profile cast is completed.

(To be continued.)

ORAL PROPHYLAXIS AND ITS RELATION TO ORTHODONTIA*

By H. C. Hartwig, D.D.S., Detroit, Mich.

In speaking before a society of orthodontists, I feel much more certain of sympathy and understanding than were I giving a paper before a group of general practitioners, because you are specializing in one branch of the profession of dentistry and I in another, while a great many general practitioners, as we well know, have no patience at all with specialists. As one specialist to another, therefore, you, who believe that bringing malposed teeth into the beautiful lines of normal occlusion is the most important and wonderful branch of dental surgery, can very readily appreciate my conviction that prophylaxis is the most important and wonderful branch of dentistry.

The criticism has been made that a paper, given before a society of orthodontists, which does not deal with some phase of mechanics receives very little consideration or discussion. I am sure that criticism is unjust and untrue—I shall be doubly sure when I am finished.

Far back in my high school days, I remember we were taught something about making sure the titles of our compositions were clearly understood. Naturally, orthodontia needs no elucidation; on the third day of your meeting, you know just about all there is to be known on that subject, but I am not at all sure that many of you could tell me exactly what prophylaxis is. Just nineteen years ago, Dr. D. D. Smith, rightly called the "father of prophylaxis," first put forth his ideas of the present system of prophylaxis, and repeatedly after that, tried to make the profession see it as he saw it, with rather discouraging results. His confreres, on the whole, refused to see the truth. As *Life* says, "No wonder truth is stranger than fiction; we spend so much less time getting acquainted with it."

Before I tell you what prophylaxis is, let me say what it is not. It is not "cleaning teeth." The heavens forbid that such a term should be used in connection with oral prophylaxis! Dentists should eliminate from their own vocabularies and from those of their patients such undignified phraseology. In one of the universities the instructor of physiology, a middle-aged man of extremely caustic temperament, had as one of his classes, the junior dental students, for whom he entertained no very friendly feelings. One day after an unusually stupid quiz session, he threw down the class cards in disgust. "Brainless, absolutely brainless," he stormed, "Oh, well, what can one expect of a bunch of tooth carpenters!" The class, furious, arose, marched out and refused to return until they were given a new instructor. That is just the way I feel when anybody talks to me about "cleaning teeth."

Moving teeth is not orthodontia, though an orthodontist does move teeth. So does the extraction specialist. He moves them—and much further than an orthodontist—but is he an orthodontist? Does he restore to lines of beauty the

*Read before the 7th Annual Meeting of the Alumni Society of the Dewey School of Orthodontia, Chicago, Ill., March 13, 1917.

facial contours? Or bring back to normal a deranged nutrition? Does he put the mouth in such condition that it is self-cleansing? Or eliminate bad gums and other dental ills?

Ideal prophylaxis is entirely preventive treatment. At the present time, however, in dealing with older people, where damage has been done by ignorance or neglect in childhood, the term signifies the halting of destructive influences in the oral tissues, including the teeth, placing the mouth in a healthy condition, and what is most important, keeping it there. The oral prophylaxis specialist, therefore, is not spending his time practicing prophylaxis in its strictest sense. The larger portion of it is employed in bringing order out of chaos; in restoring to usefulness, at least partially if not completely, teeth disabled through neglect; in combating the tendencies of such tissues, once diseased, to return to a diseased condition; and in educating his patients to an understanding of the factors imperiling mouth health and of the value of sound teeth. It was not until the tuberculosis societies began propagating educational literature concerning the great white plague that much progress was made in the campaign to stamp out that disease. When people realized that it was preventable, and what simple precautions were necessary to render it preventable, they were aroused to take care of themselves and others who might prove a source of infection. Does a tuberculosis pamphlet advise people to wait until one lung is all gone and then give a list of instructions and cures? Most emphatically not. The big thing is prevention. The best way to cure tuberculosis is not to get it. So with oral diseases, especially pyorrhea, the great white plague of the mouth. People wait until their teeth are all ready to drop out before they go to a dentist and then tell him, "Why, doctor, I never had much trouble with my teeth before. I just got this pyorrhea last Christmas."

By the way, pyorrhea is not an accurate term for this disease. The scientific name is periodonticlasia. That is, it is now, until they change it again. The finest way to cure that is not to get it, and the best way to be sure not to get it is by preventive treatment instituted in childhood. People must be taught to consult their dentists more or less frequently (especially *more*) and what is extremely important, dentists must be taught that not to recognize the early symptoms of mouth diseases and to fall down on the etiology and early pathology of these diseases, is to fail in their greatest mission,—prevention. In 1913, Dr. Charles H. Mayo, speaking before the Chicago Dental Society, voiced a doubt as to their ability to succeed in that mission when he said, "It is evident that the next great step in medical progress in the line of preventive medicine should be made by the dentists. The question is, 'Will they do it?'"

Dentistry has been accused of being a repair of wasted tooth tissue for a price. We indignantly deny such an arraignment of commercialism, for we know that in no other profession do its members work harder and more conscientiously for the public good than in our own. Naturally we must live, but we do not work for a price. However, dentists are over-zealous when it comes to repair work. They are so eager to put beautiful construction work in the mouths of their patients that they lose sight of almost everything else. In a great measure that is the fault of the dental colleges. If every college had on its faculty a member who was fairly bubbling over with enthusiasm for pre-

ventive work and had a well laid out course of instruction and line of study in that work, the students could not help but be inspired, inspired with an overwhelming desire to get out to help humanity fight the battle of prevention against the ravages of caries and disease, instead of feeling that dentistry is nothing but "filling holes in teeth for a consideration," as Dr. Smith put it. In the records of the public clinics can be plainly seen the results of the present teachings. Filling operations run up into the thousands, but prophylactic treatments are very few in number, which is a sad reflection on the importance accorded preventive study in our dental colleges.

A great many people scornfully deride prophylaxis, because their fathers or their uncles perhaps have fine mouths and sound teeth and never had a treatment in their whole lives. They do not stop to consider that, in the first place, these isolated cases are the exceptions, rather than the rule, and one usually finds, upon examining these "fine" mouths, that conditions are pretty bad. Just because some people have never needed a doctor throughout long healthful lives is no reason why the medical profession shall be abolished. In the second place, conditions have changed so remarkably in the last few years. We are all, some more, others less, driving ahead at a furious pace which tends to weaken our resistance; we lead such sedentary lives that our tissues are flabby and easily infected, our elimination is poor, and our diet so entirely lacks any hard, fibrous constituents that we can swallow almost without chewing, thereby depriving gums and teeth of the healthful massage and vigorous scouring needed to keep them in good condition. Even dentists condemn prophylaxis, on the ground that it does not do much good. People's mouths nowadays, they say, are in much worse condition than they used to be, in spite of prophylaxis. That I consider an untruth, for, keeping in mind the evil effects of our present mode of living, I believe that, comparatively speaking, people's mouths are in better condition than they used to be. One becomes so accustomed to bad conditions and accepts them so much as normal that it is not until someone else comes along and points out the glaring evils that one suddenly awakens to the fact that they are there. Dentists were so accustomed to diseased, swollen, and inflamed gums, and large deposits of tartar, and teeth were so often pulled as soon as a cavity caused pain, that they never realized conditions as they were. Now, with constant agitation, everywhere they are on the lookout for such symptoms, and notice them. When I used to walk through the woods before I knew anything about birds, I scarcely knew there were any around. After I had learned their cries, notes, and calls, and then walked over the same paths, the woods were full of birds. They had always been full, but I had not noticed them.

Our child welfare work is a form of prophylactic work. We find a child in a bad environment, with evil influences eating black holes into his character. We change his environment before we do anything else for him or before he can do anything for himself. So with the tooth. Its environment is bad, in degree differing with the individual. Acids assail it, gummy plaques hold bacteria constantly in touch with it, loose gums hold fermenting food against it. What can we do? Even if we get the patient to carefully clean his teeth, he will not be able to do a great deal of good. What we must do is change the

environment of the tooth, neutralize the acidity, remove deposits and plaques, and eliminate pockets. Then we have a tooth in a favorable environment—then and then only, has the patient a fair chance to avoid trouble. A child needs constant watching and guarding even after being placed in a new environment, lest he slip back to his old bad habits; so also does the tooth, and that is why a patient should have regular treatments. One treatment or a few treatments is not prophylaxis. It is the constant watching, guarding and maintaining the mouth in a condition of health which constitutes oral prophylaxis.

Just to illustrate the deleterious effects of fatigue on the teeth, I want to tell you what some of our research workers have been doing along that line. They have been analyzing the salivas of the pregnant women in the maternity hospital, and have found that as gestation progresses and consequently fatigue becomes greater, the calcium content of the saliva becomes lower, the occurrence of caries greater, and the resistance of the mouth becomes weaker. These results have been so constant that in the laboratory the experimenters have been able to tell from an analysis of the saliva how far pregnancy has advanced. When one considers the life of the average person today, under the stress of rushing progress and in a state of constant fatigue, can one wonder that his mouth fails to remain self-protecting, but needs prophylaxis to keep it healthy? Bacterial plaques cling to the teeth; and the saliva, which should be the protecting fluid of the mouth, no longer is able to neutralize its acidulation by these bacteria or fermentation caused by them.

In my own experience and that of others in the practice of oral prophylaxis, certain definite results have been obtained. We find that prophylaxis does prevent caries of the teeth, gingivitis, and periodonticlasia, and will cure most cases of periodonticlasia in which destruction of tissues is not too far advanced.

It checks erosion and lessens sensitivity of the teeth, especially in the cervical area, and also lessens sensitivity of the gums.

It reduces inflammation of the soft tissues and resistance to disease is increased by decreasing the number of bacteria in the mouth and thereby raising the vitality of its tissues.

Putrefaction of all sorts of material formerly left in and around the teeth is eliminated and with it bad breath; salivary secretion becomes normal, and digestive disturbances are much lessened if not cured.

The appearance of a tooth changes—it takes on a life-like appearance, smoothness, and luster not seen in untreated teeth. The gums grow hard and firm and become that beautiful pink color which is the indication of health.

One most important result is the interest stimulated in the patient to take care of his teeth himself by educating him to a keen sense of uncleanliness in the mouth. He can not know the difference between a clean mouth and a dirty one until after he has been under treatment for some time. My patients tell me they are actually uncomfortable after a dinner party because they can not brush their teeth, so sensitive have they become to the presence of foreign matter in the mouth.

Let me say right here that this education of the patient in the care of his mouth is very important. Patients must be firmly impressed by repetition and

reiteration that oral prophylaxis can not be a success if they are unwilling to cooperate with the prophylactist. If they do not carry out the instructions to take the utmost care of the teeth at home, the periodic treatments degenerate into nothing but house cleanings.

The permanent teeth in childhood are always rough, and if this roughness be not worn away by mastication and by the friction of hard fibrous food passing over them, they furnish ideal surfaces for collection of deposits, particles of food, plaques, etc., in the adult, making his mouth hard to cleanse himself—in fact, the harder he brushes, the more will he irritate his gums, brushing them over such rough surfaces. When such a case presents for treatment, all deposits are removed and these rough surfaces are planed and polished perfectly smooth. This naturally can not be done in one or two treatments, but extends over a long period of time. There are certain places so rough perhaps that they will need careful grinding before polishing. These rough spots are caused by irregularity of tooth structure. We all know how the enamel is composed of enamel rods, cemented together, running perpendicular to the surface. In various ways the cementing substance is eaten away and the weakened ends of the rods in one particular spot break off. This leaves a roughened pit in the enamel, which harbors tiny particles of food, plaques, bacteria, etc., and must be eliminated by grinding smooth, because such places are sources of irritation and acid formation and tend to decay.

From the beginning the patient is instructed in the method of brushing the teeth. That may seem unnecessary, but even dentists do not know how to most efficiently brush their teeth. Scrubbing back and forth is bad—we all know that. It abrades the teeth and injures the gums, due to the amount of force usually brought to bear in this method. The rotary method was thought good, but it does not accomplish results. The best method is the massage method, in which the gums get a large amount of massage from the side of the brush. By trying this method on the back of the hand, one will see why it is such a benefit and an improvement over other methods. Double the hand into a fist and brush between the base of the fingers and the knuckles, using the fingers for teeth. The skin is now taut and thus a bit more sensitive than its wont. Use the brush in the usual manner, bristles pointing to the surface to be brushed and brush hard. This hurts the hand, the bristles digging the skin. Now give in the massage motion, placing the side of the brush against the fingers with bristles pointing down and in brushing up, slowly turn the brush until the bristles are touching the teeth. No matter how hard one brushes, there is experienced but the warm glow of exhilaration, no irritation. Also notice that in the old way the bristles brush the rounded portion of the fingers hard, but scarcely touch the places between, where most food lodges and decay begins first. With the massage motion, note that as the brush is slowly turned from its side, the bristles spring to the spaces between and if anything were there, it would be brushed out. The massage method of brushing, if properly carried out, cleanses all such dangerous places, besides furnishing the necessary massage to the gums. That is very important, the gum massage. Brush the gums thoroughly and the teeth can not help being brushed.

Then the patient is instructed as to the correct use of dental floss. It

makes me wince to see some people use it. At a tight contact they press down on both ends of the floss until it goes through with a snap, directly onto the delicate gum septum. Then they hurriedly saw back and forth on the gum septum and jerk the floss out again. The correct way to do it is to saw back and forth gently at the contact until the floss gradually works through and to slide it down the side of one tooth with a polishing motion, up again, over the septum, down the side of the other, up and out. To make assurance doubly sure, floss should always be used before a mirror, where one can see what he is doing. With a warning to be particularly careful about the toilet of the mouth at night, during which time of inactivity of the salivary glands and oral tissues the greatest destruction takes place, and with directions to remove all particles of food remaining after meals, the patient is well along the way to take good care of himself. If there is a rough spot or flake of deposit left under the gum, the massage brushing will show it up by a point of irritation on the gum. At this stage of the proceedings, true prophylaxis begins. The patient comes to us for the constant watching and guarding of the oral cavity against the entrance of anything that may impair the usefulness, strength, comfort, or beauty of the teeth.

We all know how careless children are about keeping their teeth clean—in fact, about keeping any part of themselves clean. It reminds me of the story of the man who came home one night, all puffed up with a brand new idea. "Mary," said he to his wife, "I've thought of a scheme to cure that young rascal of ours of winking his eyes so much. I'm going to tell him what I read—that every time you wink, you give your eye a bath." With the children in the practice it takes constant lecturing, pointing out lack of care in brushing, demonstration of the right way to use brush and floss, and everlasting reiteration of the same instructions and warnings. I have been thinking seriously of making a phonograph record of my remarks and running off the record whenever necessary. If children who have prophylactic care come back month after month with deposits, particles of food gathered between the teeth and yellow stains on them, just think of what happens to children who have no such care, lacking entirely the monthly admonitions and instructions given by a guardian angel in the guise of a prophylactic specialist. In all truthfulness, the children do not regard her as any such heavenly being, even though she is forever harping—it is on one string—the string of evidences that they have not kept their teeth clean. She is just fussy in the opinion of the child. Then think of the children who also have orthodontic appliances in their mouths, crowded teeth and the lack of occlusion so bad that the teeth can not be self-cleansing even in the course of mastication. The only saving feature is that the orthodontist sees them frequently and in working about the mouth dislodges a great many food particles and extraneous matter. However, enough is retained between visits at a constant temperature of 98.6° to cause fermentation, formation of acids, decalcification, and decay.

Whether you do the prophylactic work for the child yourself or have someone else do it, drill into him the importance of not only having brushes, powder, and floss, but to use them and use them efficiently. To steadfastly gaze at them lying on the bathroom shelf will not do one iota of good. Do you

remember the little boy who was so disgusted at the size of the product of his bantam hen? He finally procured an ostrich egg, laid it in front of the nest, and wrote in large letters on a sign, "Look at this and do your durndest." Most children seem to think that to thrust the brush in the mouth and make a few mystic passes with it is doing their "durndest." Of course with the massage method of brushing, the child must be watched, lest in carrying out instructions with all the literalness of which a child is capable if he does it at all, he injure his gums or uproot appliances.

The orthodontist, in order to accomplish the various objects of his efforts, must bring the teeth into occlusion. Occlusion is defined as the normal relation of the occlusal inclined planes of the teeth when the jaws are closed. The sizes, forms, interdigitating surfaces and positions of the teeth in the arches are such as to give to one another, singly or collectively, the greatest possible support in all directions. The cusps interlock and each inclined plane serves to prevent each tooth from sliding out of position. You know these statements are true—in fact, retention depends upon their truth—so do you not see why it is necessary to keep the mouth clean and healthy so that the teeth can not decay and destroy this necessary support? It is a well established fact that it is hard to do satisfactory filling work in children's mouths, it being very difficult to restore cusps according to natural forms and to get correct contacts. Therefore, the more fillings, the more points of deviation possible from a perfect occlusion. If no filling is done, further decay causes soreness of the teeth and makes mastication troublesome which is a great detriment. Sometimes the teeth are so sore that the child does not try to chew, but gets into the habit of bolting his food, a habit which will lead to digestive disturbances in later life.

There are many prominent men who are very greatly opposed to the correction of malocclusion—why, it is impossible for a broad-minded person to comprehend. The reason they give is the decay of the teeth occasioned by the appliances and they call such conditions of decay the crimes of orthodontia. In defense I have read that decay was caused by over-use of noble metals and it was urged that they be used less extensively. Apparently that writer had never heard of prophylaxis, because he did not mention it as a prevention for these "crimes." It is really the only prevention.

Dr. Frederick McKay, of Colorado Springs, said in a recent issue of one of our journals that he was more and more impressed that orthodontists failed to recognize gingival irritations before commencing treatment (a failing, may I add, that they have in common with a large number of general practitioners). As periodonticlasia sometimes takes thirty years to develop from the initial gingivitis, the orthodontist must accept his quota of blame for future conditions of disease because he has overlooked the early symptoms in children.

Dr. D. D. Smith says that the object of prophylaxis is to bring the human mouth into a state of asepsis and purity and to "permanently preserve the pericemental membrane" in its integrity; the teeth also, and all external tissues. During movement of the teeth, with bands and ligatures adding further irritation, and during retention, the fibers of the pericementum are under stress and remain on tension long after movement is complete, until the tissues are thoroughly reestablished in harmony with the tooth in its new position. One of the

factors on which depends the time required for retention is healthy tissues. For these reasons, because so much of the success of the work depends on the condition of the pericemental membrane, it behooves the orthodontist to provide that the health of this membrane be not endangered by an unclean mouth and to take care lest he fall down on the etiology and early pathology of gingivitis. Then too, he must not subject tissues already under strain to any further irritation.

It is safe to say that anyone who has had prophylactic care since childhood will never get periodonticlasia and will be able to go through life with a minimum of repair work. Even if it is carried on only during orthodontic treatment, a habit of cleanliness will be established that will continue for years, for it is a psychological fact that habits formed during childhood persist most tenaciously in one's future years. The greatest good in the education of prevention is accomplished by starting with the children. As they grow older, the ever widening influence of what they have been taught on those with whom they come into touch will do an untold amount of good.

You orthodontists with your practices composed almost exclusively of children, do you see what your share is in accepting the sweeping challenge of Dr. Mayo to the dentists? Orthodontists were not excluded. You hold the future health of many of these children in the hollow of your hands. Dr. William Hunter, a surgeon of Charing Cross Hospital, London, England, said that crown and bridge-work was bringing temporary comfort to some people, but had silently undermined numbers of lives at present well-nigh impossible to compute. It was a menace, not a boon to humanity. Make it impossible for any of your patients ever to be obliged to have such work done and take the risk of danger. Have you the welfare of humanity enough at heart to look forward thirty or forty years, and visualize the mouth conditions which will prevail unless you do your part now? It is a great and glorious responsibility. You can not shirk it—and you will not.

The American Society of Orthodontists

THE Annual Meeting of the American Society of Orthodontists will be held at the Elms Hotel in Excelsior Springs, Mo., Wednesday, Thursday, Friday and Saturday, September 5, 6, 7 and 8, 1917. The Board of Censors have already secured many valuable papers. A more detailed account of the program will be published later.—M. N. Federspiel, D.D.S., President, Milwaukee, Wis.; F. M. Castro, D.D.S., Secretary, Cleveland, Ohio; B. E. Lischer, D.M.D., St. Louis, Mo., Chairman Board of Censors.

PRESIDENT'S ADDRESS DELIVERED BEFORE THE PACIFIC COAST SOCIETY OF ORTHODONTISTS, FEB. 12, 1917

By James David McCoy, D.D.S., Los Angeles, Calif.

THE time has arrived when we, as a body, must meet and discharge the duties and obligations incident to our annual meeting. As we enter upon our deliberations, we should not be unmindful of the responsibility entailed to ourselves, and to the special vocation we represent here upon this Coast, for a gathering such as this cannot but afford ample opportunities for increasing our capacity to better fulfill the obligations imposed upon us, in pursuing the arduous and exacting task of orthodontic practice.

The Purpose of the Society.—The purpose of this Society is the promotion of knowledge in all that pertains to orthodontia and its advancement as a distinct specialty, as well as to bring about fraternal and professional association of orthodontists, that through their cordial relationship, they may prove a help to one another.

Our aims will fall short of accomplishment, unless at all times we remain a thoroughly organized, efficient body, willing to work in harmony for the realization of our purpose, unhampered by professional jealousy, personal aggrandizement, and narrow prejudices.

The future will undoubtedly present many problems and responsibilities to us as an organization, and these we must successfully meet, if we are to retain our position as one of the chief factors for the progress of orthodontia on the Pacific Coast.

Restriction of Membership.—According to our constitution and by-laws, the membership in this Society is restricted to those who have received special training in the principles and practice of orthodontia; and furthermore, such members must be engaged in the exclusive and ethical practice of orthodontia. To some, such requirements seem far too strict, as they so greatly limit our membership at the present time. On the other hand, I feel that the accomplishments of our Society will be far greater and the resultant benefit to our specialty more telling through a smaller organization composed of men whose training and activities better equip them to cope with the problems with which we are so deeply concerned.

I trust we will not be misunderstood if we maintain this attitude as a Society, and that no one will be led to believe that we wish to establish an aristocracy in orthodontia, but rather, an academy which shall, as the years go by, become more and more a helpful factor for the advancement of our special vocation.

We are fortunate, indeed, to be engaged in the practice of orthodontia at a time when so many cobwebs of empiricism have been cleared from the structure of our specialty. Young as it is, its progress has been justly rated with the most advanced in the sphere of dentistry. The fact that the benefits of orthodontic treatment are fast becoming matters of common knowledge among the better

educated members of the laity, has resulted in a much more wholesome appreciation of the orthodontist, and a decidedly increased demand for his services.

This gratifying situation offers a decided contrast to the condition existing ten or fifteen years ago, when the demands for orthodontic services were so much less universal, and the appreciation of such services proportionately small.

The Practice of Orthodontia by Those Poorly Equipped.—The popularity of orthodontia has led many dentists who are only partially equipped to render such services, to attempt to add this branch to their practice. While this situation has its unfortunate side, it has doubtless been responsible for the dental profession coming to a more realizing sense of the demands placed upon the orthodontist, and has contributed in no small way to a keener appreciation of the real orthodontist by the profession at large.

On the other hand, it has given rise to a deplorable state of affairs, with which one is easily impressed upon a perusal of the advertising pages of some of our journals, and noting there the advertisements of dental laboratories and dental manufacturers who claim to not only make orthodontic appliances, but to furnish instructions for their use, so that the dentist wishing to handle such cases, may do so successfully (?) with their aid. Of course, the dentist who attempts orthodontic precedures under these conditions, displays an excessive amount of ignorance, and lack of appreciation of the demands of orthodontia, when he is willing to accept as a consultant, the mechanic whose knowledge of the subject, at best, is most superficial.

Dental supply men are also often called upon to furnish appliances which will correct certain cases of malocclusion. It is no wonder, then, that we hear of failures under such circumstances, for we all realize that when practiced even under the most advantageous circumstances, orthodontic procedures are often beset with pitfalls and discouragements.

It is to be hoped the time will come when the publishers of our various journals will come to a realizing sense of their responsibility in publishing such misleading advertisements as those referred to, for such advertisements belittle the science of orthodontia, and detract from the dignity of the journal which carries them.

It is a lamentable fact that many dentists who consider more or less seriously the question of perfecting their knowledge along orthodontic lines, seem to feel that the demands of orthodontia are, for the most part, met with upon acquiring the working knowledge of physics and dynamics of corrective appliances.

The Importance of Etiology.—As a rule, those who regard orthodontic treatment in the light of a purely mechanical procedure are all too apt to relegate the question of etiology to a position of secondary importance, their idea being that the correction of all local conditions which make possible along normal lines, mechanics of occlusion and respiration, etc., constitutes safety in treatment.

However, to the thoughtful and scientific orthodontist, the fallacy of this attitude is very apparent, owing to the fact in a certain percentage of cases, even where the most careful treatment and retention have been carried out, failure in some degrees ensues, leading us to the conclusion that there is yet a vast amount of information to be gathered concerning the etiology of malocclusion.

Dr. Angle has stated: "The causes of malocclusion to be intelligently comprehended, must be studied from the basis of the normal growth of the denture and its correlated parts. Most of the immediate causes are mechanical, yet whatever acts as a hindrance to nature, in performing her delicate offices in the unfolding of the various tissues composing the dental apparatus, hindering its growth, will be operative as a cause in producing malocclusion."

While almost everyone appreciates the mechanical causes, I think I am safe in stating that comparatively few appreciate the causes that lie deeper, and which "act as a hindrance to nature performing her delicate offices," which naturally leads us to the conclusion that the orthodontist, in justice to himself and his patients, should be as thoroughly schooled in the basic principles of physiology and pathology as any other surgeon who devotes his energy to the field of orthopedics, or who aims to direct development along normal lines.

Constitutional Disorders as a Factor.—In considering constitutional disorders as a factor, it is but natural to seek out those which are active in interferring with the progress of development in the dental apparatus, and which are injurious to the tissues which enter into the formation of the structures concerned.

As we reflect upon this point, we are impressed with the fact that in the dental apparatus, as we consider it, we have all the principal tissues which are found in the other parts of the skeleton, namely, epithelium, the connecting tissues, muscular, and nervous tissues. Therefore, we have no reason to assume that these tissues, as they are associated in the dental apparatus, are any less subject to the effect of constitutional disturbances than they are in other parts of the body.

Therefore, as emphasized before, until physiology and pathology become more of an open book to us than they are now, we will be at a loss to account for certain arrestments of development, occurring not only in our field of endeavor, but also in the human organism as a whole.

There is enough evidence, however, to lead us to think that certain diseases have an important bearing upon development, or more properly speaking, upon arrestments of development occurring in the oral structures. These conditions I will enumerate briefly as follows:

1. The ordinary diseases of childhood, which are accompanied with high temperature.
2. Congenital or hereditary syphilis.
3. Rickets.
4. Diseases of the internal secretory organs.

I will make no attempt to discuss the various phases of these subjects, for that has already been done at previous meetings of this Society, but would urge a more consistent observation of these conditions, as we uncover them in taking the histories of our cases, so that we can realize in a more definite way, their significance.

The last cause mentioned, namely, diseases of the internal secretory organs, brings to our minds a field which is, as yet, imperfectly explored, although we know that the internal secretory organs have a definite relationship to bodily

development and nutrition. We know that these glands, the principal of which are the pituitary, the adrenals, the thyroid, the parathyroids, the thymus, the testes, and the ovaries, are supposed to preside by virtue of their secretions, or in some cryptic manner, over certain correlations of the body.

"It has been claimed for these tissues and glands, that they are cooperative with, or compensate and inhibit, each other in cycle, and that any interfering influence or disease which disturbs this coordination, seriously and very diversely affects nutrition, bodily development and functions."[1] Just how great a factor these organs are in the etiology of malocclusion is a matter which physiologists will have to aid us in settling, but the importance of these structures is not to be underestimated, nor should we lose sight of them in our investigations.

Before leaving the subject of etiology, I would emphasize a point made by one of our confreres[2] that "the process involved in the establishment of malocclusion may be said to begin with the differentiation of the cells destined to become the future dental organs, and end with the completed, permanent dentition. If these are accepted as the two extremes of the period during which malocclusal conditions may arise, it is evident that there is a vast range of circumstances that must be taken cognizance of, if a careful examination into the causative factors of this disturbance be undertaken."

Fixed Versus Removable Appliances.—In reviewing the progress in methods of treatment during the last few years, it is interesting to note that fixed appliances have in no way lost prestige, and in fact, are now recognized almost universally by scientific orthodontists as the most rational and effective in our work.

So thoroughly has this been proved, that we hear little controversy or argument from those who, for a time, were loud in their claims for removable appliances. The old saying that the proof of the pudding is in the eating applies with significance in this connection, for it has been proved that through the proper use of fixed appliances, results can be obtained with a uniform degree of accuracy.

We all realize the great importance of being able to keep the force being applied to moving teeth under absolute control at all times. If an appliance can not be so constructed that we can maintain this control, it at once becomes a dangerous agent, relatively speaking.

Recent developments in orthodontic appliances make it possible for us to have more accurate control over applied force than we have ever had before, as well as making possible the application to the teeth to be moved, a degree of force which, in character, is best suited to effect the physiological changes so much desired.

Metals Used for Appliances.—"The materials used for the construction of fixed appliances have as much to do with the principle of fixation, as any other factor. For example, an appliance constructed of the noble metals will not disintegrate, its temper will always remain even, though attachments be soldered to it, and its integrity will never be impaired by use in the mouth."[3]

On the other hand, an appliance constructed of base metals disintegrates to

---

[1]Grieves, Clarence J.: Am. Soc. of Orthodontists, 14th annual meeting.
[2]Hellman, Milo: Dental Cosmos, Sept., 1914.
[3]Casto, Frank M.: Jour. National Dental Assn., Jan., 1917.

a certain degree in the mouth, loses its temper through soldered attachments, and thereby its usefulness is often seriously impaired.

For this reason, I feel that the use of base metals as orthodontic appliances is contraindicated, notwithstanding the fact that such appliances are highly advertised, and by some few are defended with vigor.

In the opinion of your essayist, the only quality for which the base metal appliances can be recommended is for their cheapness, and often this fails to be an argument in their favor, as they require more time and trouble in manipulation.

It has been claimed by the exponents of base metal appliances that teeth banded with these materials are less apt to disintegrate than if banded with gold, platinum, or its alloys. It seems to me that such a claim will not stand the test of rigid investigation. Notwithstanding the fact that disintegrations do occur once in a while upon teeth carrying bands, a careful scrutiny of such cases will usually reveal the fact that this unfortunate condition was the result of either poorly constructed or poorly cemented bands, which made possible the lodgment of debris or the formation of plaques against the enamel surface, and was not due to the material composing the appliance.

In my remarks thus far, I have touched upon numerous subjects which appeal to me as important not only to us as a Society, but to orthodontia. In your consideration of my ideas upon the subject, I trust your discussion will be marked with that degree of candor which should exist between men brought together by the bond of a common purpose.

Perhaps, in our meeting, we will not bring out anything which is startlingly new or original, but we are certain, through our discussions and through our interchange of ideas, to be able to carry away much which will not only increase our capacity for better fulfilling our professional obligations, but will instill within us renewed courage and enthusiasm.

DISCUSSION.

Dr. Cavanagh.—Mr. President, Fellow Members of our Society, and Guests: I trust in consideration of the fact that this paper has been excellently and carefully prepared, you will expect but little of the one who is to open the discussion, especially since I have had no opportunity whatever of knowing the lines along which our President was going to speak. He touches first on the question of membership in this Society,—whether or not we shall admit those who are not following this work exclusively. We, who have taken special instruction in orthodontia, are in a much better position to realize the vast difference between the general practitioner who dabbles in some orthodontia, and those who are really qualified for practice, both by training and years of valuable experience. For myself, I feel if we admit those who are unprepared (not having taken a course) we have no way of limiting any man who performs any operations in orthodontia, regardless of whether he regards it as merely a mechanical procedure or not. We will have no way of excluding any of those who are endeavoring to perform orthodontic work, and if such be admitted, our Society would become unwieldy. Therefore, I think our membership should be limited in the future as it has been in the past. In order to do justice to the other points which the President mentioned, I would have needed the paper for perhaps many hours, and I might not have done so even then. We have, however, I think been postponing the treatment of cases until too late in life. Perhaps it was not our fault, inasmuch as our work is largely referred work. In orthopedic surgery, operations are not postponed until the child is ten, eleven, twelve or fifteen years of age. In the dental profession, unfortunately, many members advise the postponement of corrective measures until beyond the age when it is possible to obtain the best results with the least effort, inconvenience, and expense to the patient. All this shows that we still have important educational work to do.

I am quite a believer in the theories of Dr. Bogue, of New York City. In the articles published in the Dental Digest, I think some excellent points are being brought out. This Journal reaches more of the dentists than our publications do. Dr. Bogue recommends patients for treatment at a much earlier age than is ordinarily done. Several years ago I went over the cases I had had up to that time, and found the average age of patients referred to me on my return from the East after taking the course was twelve years. This was out of the first fifty cases. I find up to a year ago, averaging up the cases referred, the age had been reduced to nine years, and from the proportion of cases where only the deciduous teeth are present (in those cases I have on hand at this time) I think that age has been reduced to approximately seven years as an average age. That has been the result of my effort,—to reduce the age at which patients are referred to me for treatment.

There is very little more that I can touch upon at this time, although it deserves a vast amount of discussion. The fact that I did not have the privilege of going over the paper prior to coming here, will make my part of the discussion necessarily brief. I therefore will leave it in the hands of the other members present for further discussion.

Dr. Suggett.—Mr. President, I enjoyed the paper very much. For a number of years I have been much interested in the matter of the proper selection of appliances, and for some time have been using only the noble metals. It seems to me the objections urged to the use of these metals are practically the same objections which may be urged with reference to gold fillings and crowns. Some dentists think they see damage from the bands,—a damage which is exerted on teeth adjacent to those which are banded. If that is true, the same objection would apply to gold crowns and fillings, or any use of gold or precious metals that would touch another tooth.

As to the appliances, it seems to me from my own experience and from that of others, the tendency is drifting not only toward the direct attachments, but I think toward a smaller wire. For a year past I have not put on a wire larger than the .0225. That seemed small at first, but I know several years ago when I saw Dr. Young give a clinic with .030 wire, it seemed too small. But since then we have changed our method quite radically. Instead of using an attachment only from molar to molar, with ligatures, etc., we are now attaching to every tooth, or every other tooth and getting an attachment at every half inch instead of two or four inches. Since using the .0225 wire, I have found I can secure much better control and more rapidity of movement than with the .030 wire, for the reason that it is so flexible and is easier to manage and one can give a bigger spread to it than the .030 wire. Where you have an attachment, say to central or lateral incisors, you have such a small distance between the teeth that with the .030 wire your spread must be very, very small. With the .0025 wire, the spread can be much greater, and you can often let a case go much longer with it. It is simpler in making and there is no need of mechanical appliances for soldering. This eliminates the buccal tube, the middle section, and end sections,—so that this is a simpler appliance to use. I think there is no need to use pins that were furnished before at forty cents a pin. The .0225 wire is the same size as the pin we want to use, and you have the same rigidity you have in the wire.

The only objection I have found, is sometimes encountered with upper molars which are in lingual occlusion. I have found it difficult to jump the overbite. When this difficulty is encountered, I work with the case until about finished, leaving the molars still in lingual occlusion. Then with a short period of treatment with the buccal tube and 16 or 18 gauge wire, I move the molar teeth over and line them up quickly.

I think the tendency is toward the use of a smaller wire. Dr. Angle shows that tendency in his last appliance, and I think the profession is convinced that tooth movement does not require a great force but a constant one. In closing up a large space where a molar or bicuspid is missing, the smaller wire works better. We can get the loop with a spread that would work for two or three months safely and without any additional pressure being put on. The larger the wire, the less the change we can make each time.

The paper has touched on some of the deep causes back of some of these cases. These are the things that puzzle us. Two cases may be very similar in many respects: one may have the tendency to return for years and years, and the other to stay in its new position. So we feel there are many things we do not know yet, and so we are pursuing the subject with more and more open minds, and are willing to be taught. The dental profession feels we are not as dogmatic as we were a few years ago. We realize there is much to be learned by experience and from each other.

Dr. Engstrom.—The President's address was of considerable interest to me and a

number of factors were touched upon which I have thought about for some time past, particularly etiology and the retention of cases.

In regard to the organization of the Pacific Coast Society of Orthodontists, I am heartily in accord with the essayist in the desire that the membership be confined to those who practice orthodontia exclusively. No doubt the Society would become unwieldy, as Dr. Cavanagh stated, if a different course were followed. We have in our by-laws a section which states that every member shall take part in the proceedings of each session. This brings us closer together, and thus a great deal more good may be accomplished.

In regard to the etiology of malocclusions, undoubtedly it is very true there are many causes which are very much in the dark, as it were. Aside from the idea that malocclusions may begin at any time from the first operation of the cell to the completion of the dental arch, or later, it appears to me that if malocclusions may be acquired at a later period in life and corrected, that should a condition exist prior to birth, that condition may be rectified and not stand against the case as a hereditary element, as it were.

In our own work we may have two cases practically the same, but the result in one will be much more satisfactory than in the other. So it seems to me, there is a cause not to be accredited to the operator entirely, but which lies within the patient himself. If a disease attacks the body, we naturally have to depend upon the resistance of the body to overcome the disease, whatever methods may be pursued in the cure, and that resistance is in the patient. We cannot make it. And so in the correction of conditions of malocclusion, we must depend to a considerable extent on the ability of the patient to follow instructions and to do for himself that which would bring about a correction of the abnormal functions that existed prior to the treatment. That appears in some instances to be largely a matter of the mind and I have always considered the mind to be an influence in the formation of malocclusions and also in the correction of them. A person may use a part as he desires, and thus develop it properly or not. This may apply with reference to the use of the nose. Quite often the mouth is used for the nose. Under such conditions we are bound to have an abnormal structure so far as the mouth is concerned. Now, if the patient will not correct the habit by mental effort, the success of our work is practically nil, because the abnormal function that existed before the correction, surely will tend to bring about a return to the malocclusion. I thank you.

Dr. Martin Dewey.—Mr. Chairman and Members: There are a great many things in the President's address I could discuss and many things on which I could disagree with him, but I will not take that liberty to a very great extent. As to noble and base metals, I think he has referred to me, as I have advocated base metals. Several years ago we had a discussion in Chicago on this matter, and I was practically alone in advocating base metals. That certain metals possess certain properties you admit. Platinum has certain properties, and we would like to use something in its place, but we cannot find a substitute in the commercial world. Iridio-platinum has certain qualities making it desirable for use in regulating appliances, but it has no antiseptic properties. I agree with Dr. McCoy, to a certain extent, that a band properly fitted would not decay the tooth, yet some of the men in the East have said it was possible to have a gold band fitted so close to a tooth that you would exclude every bit of cement from between the band and the tooth. The value of the cement is evidently not understood for you can take a band off a tooth under careful conditions, remove a piece of cement from the band and get a beautiful culture of microorganisms. Cement does not possess as many antiseptic properties as we formerly believed. Now you can carry the experiment further, as has been done. In the mouth of the same patient you can have iridio-platinum bands and bands of base metal alloy. You can make cultures from the two bands using two different test tubes. The culture from the iridio-platinum band will contain twice as many mircroorganisms as those from the other band.

It is a fact, as Dr. Suggett has suggested, we need only to think of gold fillings and gold crowns. No doubt these do decay teeth. Self-cleansing fillings, etc., are necessary. We try to provide for mechanical cleansing,—to avoid the accumulation of debris between the teeth. We have to consider that the banded tooth has a certain danger to the approximating tooth. With noble metal touching a tooth, that tooth is always liable to decay. Many men are realizing this. How they will meet this situation we do not know. We know iridio-platinum has certain properties which make its use necessary in certain instances, but we should use a metal containing some proportion of copper and zinc. Metallurgists are working on it.

We need to realize that where noble metals are used, more scrupulous care must be taken than is employed by the average orthodontist.

Dr. Ketcham.—In speaking of noble metals causing decay of the teeth as Dr. Dewey expressed it, I wonder whether the percentage of decayed teeth where we have the noble metals in use, is any greater than in the mouths where no noble metals are used. For instance, in a mouth where amalgam fillings are used, it seems to me instead of a chemical or metallurgical problem, the decay of adjoining teeth is more a question of environment and prophylaxis, and it could be taken care of by cleanliness. I believe the endeavor of some of our operators to so shape their restorations as to make them self-cleansing, is simply an effort to reproduce the anatomical structure of the tooth the same as though the tooth had not decayed, and that in reality in our orthodontic appliances the question of decay is primarily one of prophylaxis. In other words, is the likelihood of decay where precious metals are used and where alloys containing a greater percentage of copper and zinc are used, very much greater in the one case than the other? The edge of an iridio-platinum band may be raised a bit,—the cement washes out and we have decay. When a German-silver band is used, we may have more stretch, and the same is true of some of the gold alloys. coin gold, for instance. It is a question whether scientifically the use of gold and platinum in juxtaposition to a tooth will render decay greater or not.

Dr. Solley.—I am sorry I was not here to hear the President's address, as it would have been of great interest to me. Three years ago I brought a subject before this Society and have been doing considerable experimenting on it since then, and I have had the idea that I was probably the only man having trouble along this line. I dropped the subject and am sorry I did. At that time I had one particular patient where I had been using platinum appliances and had much disintegration and had to do something and so I turned around and used certain base metal appliances. With the use of these latter appliances I had fully 85% improvement, I think, so far as disintegration of tooth structure is concerned, in that particular mouth. It was a very serious case, and I felt it was the only way I could have carried the case on. I saw the patient six months ago and I still have that particular retaining appliance on.

I wish to ask Dr. Dewey a question as to cements and cultures. Has he tried any of these new copper cements which are on the market? Is there any improvement from the standpoint of disintegration in the use of these copper cements?

Dr. Dewey.—Copper cement has a decided antiseptic property, and I should have qualified my statement as to cements. Cements containing 3% copper, have little antiseptic properties. Copper cement containing a greater percentage of copper has much greater antiseptic value.

With reference to Dr. Ketcham's remarks as to iridio-platinum, and gold and platinum, and the liability of tooth decay, I think scientific findings are what we want. Iridio-platinum and gold have no antiseptic properties. The other metals mentioned do have. You can prove the question in regard to these metals by making an experiment on agar-agar plates. Take the iridio-platinum and the gold and platinum and the microorganisms crawl up over the metal. While around metal containing copper or zinc you will find a clear space. The microorganisms have died.

I could cite you a number of men, prominent in the orthodontic world, who are discontinuing the use of iridio-platinum and gold and platinum. A large portion of the cases of decay in many mouths can be traced to the use of noble metals. It is a fact and not an imaginary proposition. The experience of Dr. Solley has been the experience of a number of men, and while we must use noble metals, we must not deceive ourselves, because a band keeps clean. into a belief that it may not cause decay of a tooth. A thing may be perfectly clean macroscopically, and still be covered with microorganisms. This decays a tooth, and not the oxidation of your appliances.

Dr. Hampton.—I am just a visitor here and I appreciate the kindness extended to me, and I have enjoyed the President's address very much. I am in general practice. I noted Dr. Dewey's statements with reference to tooth decay occurring adjacent to a gold filling and his remarks with reference to zinc and copper. Is it a question as to whether the galvanic action destroys the microorganisms, where you do not have that action in the so-called noble metals? I have been interested in that question for a long time. Having been a farmer in my earlier life, I found posts in the ground did not decay as much in the ground as above the ground and you find that the case where you have the gold fillings and the copper or zinc fillings adjacent,—where below the gum or above the gum may have a similar effect.

Dr. Carter.—Mr. Chairman and Gentlemen: I came in almost too late to hear enough of this paper to discuss it, but relative to whether or not it is best to use noble metals

or some metals containing copper and zinc, I believe a great deal of the decay going on in the mouth is not entirely due to the metals that we use but is probably due to a lack of prophylactic measures many times. I believe we sometimes put bands on teeth and send the patients out and tell them to return in a month. It appears to me that it would not make a lot of difference whether platinum or gold or base metal appliances were used, there would be a great liability of decay under such circumstances. Although there may be some merits in the base metal in appliances, I think much of our trouble could be eradicated by better attention to prophylaxis in many cases.

Dr. McCoy.—I will not consume any time in closing the discussion. I was sorry not to be able to place this paper in Dr. Cavanagh's hands prior to the meeting, as it placed him at a disadvantage, but in rush of preparation for this meeting my address was not completed in time to get it to him.

I am much pleased to think my remarks have evoked as much discussion as they have, and I trust that even though we may not have settled anything definitely we may feel stimulated to direct our energies along the disputed lines and eventually do our share in their settlement.

THE QUESTION OF A UNIVERSAL APPLIANCE*

By Harry P. Beaser, D.D.S., Fresno, Calif.

AT the time the healing art became recognized as such and was separated from the barber trade, the search for a panacea for all ills began. As time progressed, the different departments of the "Profession of Medicine," as it was now called, began to divide into specialties, and the search has continued, the searchers declaring from time to time that the wonderful discovery has been made, and therefore the troubles from that particular thing are at an end forever. The statement that the drug, the apparatus, the appliance, or the process system was all that any one need have to accomplish the perfect result has often been heralded, but has always proved false.

As this was true in times past, it is equally true at the present for one need only to pick up a magazine, technical or otherwise, to read the announcement of some one claiming that he has at last discovered the necessary thing to fill all the requirements in the treatment of this or that, and it is further stated that it is so simple that most any one can use it. All you have to do is to get the original article, usually patented, from the inventor or his agent, and the result will follow without any further attention from the operator.

As we are naturally a mechanically inclined race of people, and dentistry being largely a mechanical science, it follows that a great deal of attention is directed toward dentistry by the panacea searcher, and the science of orthodontia, being carried on practically altogether by mechanical means, receives a full share of attention.

There is no doubt but that most inventors of systems and universal appliances are absolutely sincere in their statements regarding the uses of their inventions, but their enthusiasm over their discoveries leads the unsuspecting and undereducated person to believe that all that is required is to adjust the appliance to any case, turn the crank, and grind out the result.

*Read before the Alumni Society of the Dewey School of Orthodontia, Chicago, Ill., March 13, 14, 15, and 16, 1917.

Experience soon tells them such is not the case, no matter how clever they may be in the technical part of their work. The fact that they have overlooked the most important thing—diagnosis—never occurs to them. If it were not proved in a great many other ways, this would be sufficient to show that the appliance so represented was not universal and could not be applied to every case. More proof can be obtained by reviewing the statements made by the originators of so-called universal appliances and systems. One need only to study briefly some of the appliances first invented and shown to the profession with explanations and arguments given to prove that the treatment of malocclusion can be accomplished by the proper handling of said mechanism in all cases. A few years later, a new appliance is evolved by the same person, or some one else, and the same statements made in regard to the latter that were made in regard to the first. Coming on down a period of five or six years more, orthodontia is again revolutionized, and the orthodontist is asked to believe that the latest creation is the only thing, and to discard all others regardless of what success may have been obtained through their use. Thus have the originators admitted the weakness of their arguments in the first cases without giving sufficiently more to substantiate their demand for the position of the universal appliance, in the latter cases.

The profession as a whole is largely to blame, being prone to accept anything that is offered and will afford an easy means to an end. They have demanded hard and fast rules of procedure because they have been too busy to think for themselves, or, as it is in some cases, their (professional ?) thoughts have never gone beyond the sign of the dollar. However, let this be as it may. The time has arrived when the majority of the men, entering the special fields, realize that there is something to be made out of the profession besides money, and are, therefore, demanding the reasons for statements made, instead of accepting them blindly. Their course of procedure is based upon scientific facts produced by research workers and not upon faith or sentiment, and they have learned that no success can be obtained without thorough knowledge, close study, and hard work.

Physics has given us certain mechanical forces which are simple to understand, the only difficulty being in measuring the power of these forces: e. g., two pieces of wire of the same kind and size will be found to possess vastly different degrees of elasticity and their other qualities will vary considerably in relation to each other. Unless this fact is thoroughly understood and taken into consideration in the construction of an appliance, a normal physiological tooth movement will not be obtained except by accident. The only difference between appliances is the difference in their construction, attachment, and the materials from which they are made. The forces are the same, so upon the construction, materials and manner of attachment hinges the whole question.

No form of treatment should be undertaken without a thorough diagnosis, and diagnosis in orthodontia means more than simply classification of the malocclusion. It must be made from many other different points of view, as physiological, anatomical (both general and special), mental, moral, psychological, etc., all of these having a strong bearing upon the treatment to follow, and unless taken into consideration, the operator is working in the dark.

To go into these points more in detail, the following points will be determined: Upon superficial examination, what is the malocclusion,—a mesioclusion, a distoclusion, or a neutroclusion? What are its complications? Which of the natural forces of occlusion are upset and working in disharmony? What are the causative factors which are to blame for this disharmony? What is the physiological condition of the patient at the present time, and what has it been in the past? Anatomically, what is the general build of the patient? To what general type does he belong? Which of the basic forms of teeth has he ,or what modifications of the basic forms does he possess? Do these points correspond. or are they opposed to each other? What is his mental capacity and also that of his parents? From the psychological side of the question, what is the attitude of the parents or guardian towards the work to be done and toward the operator? The moral point, or the moral risk, is the risk that the operator takes, and may be likened to that which a banker considers when making a loan. A careful and complete history on all the points must be obtained from the patient and as much as possible from the parents. If any one of these considerations are overlooked. it will fall just that far short of being complete and whatever is left out of the diagnosis, a corresponding part is left out of the treatment. A negative or a positive answer to any of the questions will make a very decided difference in the prognosis and treatment.

Treatment, in orthodontia, to a great extent, means the use of appliances, and it would be just as reasonable to assume that an orthodontist could treat all cases of malocclusion with the same appliance, as to assume that a physician could treat all diseases with the same kind of medicine.

Each basic type of malocclusion, if viewed separately, might be said to require the same mechanical forces applied in the same way, and I am inclined to believe that the originators of systems and universal appliances have viewed the whole subject of orthodontia in that way only, failing to take note of the other points in the diagnosis and their relative effect upon the treatment.

Each basic type of malocclusion is brought about, usually, by the same primary cause. The complications which we find in each of the three basic types, are produced by the secondary causes, which are mainly the forces of occlusion working out of harmony, having been upset by the primary cause. However, there will be found enough difference in the individuals, physiologically, anatomically, mentally, socially, etc., to require an absolutely different, or a much modified, appliance in each case or group of cases.

One may take twenty cases of the same type of malocclusion and not find the diagnosis corresponding exactly between any of them. Two will not be found having exactly the same physical build and strength, and all the different facial and tooth types will be present. A vast difference will be found in their social and mental status, and psychologically viewing them, each will form an object of study by itself.

Although some small differences may not have much bearing upon the treatment, it can readily be seen that the appliance indicated in one case might easily be contraindicated in another. The shape of the teeth in one case would

permit of an easy application of ligatures, while in another it would not. The ease or difficulty of adjusting bands would be governed in the same way.

The environment in which the patient lives, his personal habits, and the attitude of his immediate family will have much to do in the selection of an appliance, and the prognosis.

Whenever an orthodontist accepts a case, he assumes a responsibility and with it a certain risk, and unless he considers long and carefully all the points of diagnosis, his course of procedure may be wrongly influenced to such an extent as to make a successful result impossible.

As we know, appliances are divided (relative to their attachment) into two groups,—the fixed and removable, and a third might be added, the fixed-removable, as Dr. Eby terms it. Each of these has qualities in its favor and other features that are not desirable; but what would be an undesirable feature with one patient would be a very desirable feature with another, so the consideration of the appliance is decidedly secondary to that of the patient who is to wear it, or to diagnosis.

The argument might be put forth that an appliance in the hands of one man is much more efficient than in the hands of another, and there is much truth in the statement, but in this paper I am assuming, for the sake of argument, that all operators are equally skilled. Therefore, if an appliance possesses virtues for one, it certainly must possess virtues for all, and if any orthodontist finds that he cannot produce the degree of success that some other one has in the handling of an appliance, he discovers thereby his own deficiencies and should immediately train himself to master the art. It is true that the same principles might be exemplified in different ways, and also certain appliances may possess a greater number of qualities than others, giving them a wider range of usefulness. Some may approach the goal of universalness much nearer than others, but none will ever reach it. The principles of orthodontia cannot be exemplified by any one system or appliance, and as soon as the profession realizes that the appliance must fit the case, instead of the case fitting the appliance, just that soon will it begin to conserve its energy and apply it in a more useful direction. It is unwise to attempt the impossible, as it only wastes time.. The principles have already been discovered so it is better to exert one's energies for the possession of knowledge and train oneself in technical skill if a perfect result is desired.

PRESIDENT'S ADDRESS BEFORE THE ALUMNI SOCIETY OF THE DEWEY SCHOOL OF ORTHODONTIA*

By A. C. Gifford, D.D.S., Oshkosh, Wisconsin.

It is with pleasure that I greet you, friends and members of the Alumni, and I welcome you most heartily. As we come together for this meeting, we let our minds wander back to that last meeting about a year ago in Kansas City and think of the good things we absorbed there. Those of you who attended that meeting have, I know, been helped in your year's work and I know

*Delivered before the 7th Annual Meeting of the Alumni Society of the Dewey School of Orthodontia, Chicago, Ill., March 13, 1917.

that you who are present now will gain information of even more value than we did then, as the program for this meeting can not be outclassed. I think you will agree with me that it will be almost impossible to digest all this in the short time we have, but we will have food for thought. Were it not for these meetings, we would not advance our science, neither would we advance in our science. Naturally each meeting of this society will be larger and if we all put forth the effort, we can have meetings that will be talked about throughout this country and will not be lacking in one single unit. We now have members in the North, South, East, and West, and we can form a federation by which we can select the best talent in oral surgery, oral prophylaxis, roentgenology, pathology, and orthodontia. A knowledge of all these subjects is necessary, I think, and in this way we shall get a clearer conception of what the results will finally be. We can not practice orthodontia without this, and give our patients what they expect—efficient service.

Not so many years ago a specialist in dentistry or medicine was rare, now there are specialists in almost every phase of both sciences. It will not be long before each of our most talented men will have his chosen specialty and then the laity will be taken care of as it should. No man can give his best efforts to more than one class of work. If the mind is upon one particular subject, that he can do most perfectly. If we are to become proficient in orthodontia, we must take time for the study of methods and so forth. Each case coming into our hands for treatment must have its share of careful study if our results are to be perfect, as a completed case should be. The more familiar we become with our work, the more we realize our responsibility, and as I heard one of our foremost orthodontists say not long ago, "When one begins practice in the chosen specialty of orthodontia, he thinks he knows all about it; but after ten years of work and study, he is still far from knowing it all." It is so easy to fall behind the line that we must grasp every opportunity to keep up with the procession.

Orthodontia of today is not what it was even one year ago, for the progress it is making is wonderful. The advance has been along lines of bodily tooth movement, and I think we will find that this is the most practical movement, inasmuch as the case will be completed when we are through treatment, and will leave nothing for nature to do. When the teeth are tipped, we expect nature or the force of the inclined plane to complete our work, and sometimes it does and sometimes it does not. It is the aim of our most eminent specialists to produce results without the disfiguring, conspicuous appliances of former times. It should be our purpose to use appliances which do not disfigure the patient with unnecessary ornaments, if we can produce perfect results thereby. We will have an opportunity at this meeting to see what can be done without the use of disfiguring appliances. I think that you will agree with me, however, that the appliances with which the teeth are moved into alignment and occlusion are not so important as the apparatus that shall retain our finished results. The plain arch and anchor bands will in a given time, with the proper attention and ligation, bring the teeth into occlusion or near occlusion. The occlusion that has not been produced by this method will be produced by the inclined planes if the teeth are in a position so that the force of the inclined plane

can act. Retention is one of the greatest problems of orthodontic practice. How often have we produced normal results and put the teeth in proper alignment only to find after a little while that our mechanical ideas as to the retaining appliance have not held and that the teeth are again "homeward bound." A tooth that has been in torsiversion is most liable to wander back or part way back to the abnormal position it formerly occupied. Especially is this true in cases where the patients are of advanced ages. It is for those of us who are mechanically inclined to bring forward some retaining device that will not include conspicuous bands, and still hold the teeth where they belong. I am aware that each case requires a different method of retention, but one can make whatever he desires if he has some nucleus upon which to build.

If we expect our results to be successful, we must be sure that our patient has enough space for the third molars to erupt. The patient must be kept under observation as much as possible for if these third molars, especially inferiors, have the least wedging force, it is impossible to keep the teeth in alignment. I have been consulted by clients at the age when third molars were erupting, and I could not understand for a long time why the teeth should become so irregular at that time, but after careful thought, I convinced myself that there lay the cause, consequently I am advising the extraction of third molars when present, and I find I have less trouble.

I am of the opinion that we should help the general practitioner to have a better conception of the diagnosis of abnormal conditions and the causes producing those conditions, for this is where our dental colleges fail. Orthodontia in a dental college should not consist of making bands and fitting arches, but in the study of the general condition of the oral cavity pertaining to abnormal conditions and to the causes of malocclusion. I do not mean Class I, II, or III, or neutroclusion, distoclusion or mesioclusion, but the general diagnosis of the entire oral cavity. There are few I find who recognize malocclusion when it is present. Can the general practitioner do justice to his patient if he is unable to diagnose malocclusion? Are not these children sent to him by their parents or guardian for service and advice? Many a general practitioner has lost a good client by not seeing these deformed mouths before some "Good Samaritan" informed the parent that the child needed orthodontic treatment. A knowledge of the force of the inclined plane is very essential to the general practitioner as we find fillings that are smooth, and crowns that are like tin cans with no approximal contact. How are the orthodontists to get and keep perfect results when the teeth can not occlude properly and retention is almost impossible?

Our program shows that we are to have an address on orthodontic legislation which is something we have not had heretofore. If any one needs legislation, it is the orthodontist; and I hope we may be able to put something before orthodontists and members of the dental profession that will finally become a law.

It has been the custom heretofore to hold two meetings each year, but I found that we had almost two different classes at each meeting. I thought perhaps they would all come at once, and I believe I was right, for we have never had the attendance we will have at this meeting.

Before closing this address, I wish to thank the members of this society for the honor they have conferred upon me in choosing me as their presiding officer for the past year, and I also want to thank the secretary, treasurer, and members of the various committees, who have worked so nobly to make this, our annual meeting, a success.

ORTHODONTIC APPRECIATION*

By Oscar Busby, D.D.S., Marshall, Texas.

Dental Surgeon, Texas and Pacific and Marshall and East Texas Railways Company.

MR. PRESIDENT and Gentlemen of the Alumni Society of the Dewey School of Orthodontia: After receiving the second letter, from the chairman of the program committee, stating that in order to make this the greatest meeting in the history of this society, every alumnus was expected to contribute to the program, through my appreciation of the already great accomplishments of this society and my loving gratitude toward its founder and members, I have consented, though conscious that my sense of duty is greater than my ability. There is nothing of clinical nor scientific value in this paper, but if in its consummation you should find some intrinsic stimulation, I shall feel repaid for this exertion.

The development of orthodontic appreciation has followed closely the development of orthodontic science and has its culmination in the successful application of the practical principles of orthodontia. In the beginning of his own career, in a community where modern orthodontia has never before been practiced, the orthodontist should be keen enough to recognize the difference between mere orthodontic enthusiasm and real orthodontic appreciation. The former, while a necessary element, may be inspired by plaster models and various regulating appliances which serve only to the imagination and enthusiasm of both his patients and himself. Such enthusiasm is based upon unfinished work, while on the other hand, through the intelligent application of the scientific principles of orthodontia, this enthusiasm resolves itself finally, into the appreciation of finished work, thus slowly establishing in the minds of the community that confidence and recognition which orthodontic treatment deserves.

Malocclusion of the teeth and its treatment has, in all periods of civilization and intelligence, attracted, in varying degrees, the attention of writers and practitioners of both dentistry and medicine as is attested by Dr. Weinberger's excellent "History of Orthodontia" in which is shown pictures of the crudest appliances and the most primitive conceptions of their application. From these crude appliances and primitive conceptions a few men, who had both the ability and inclination, have developed a direct and positive science, a science embracing sufficient work and study to occupy the entire time and consideration of the most learned scientists and practitioners of the present time. Those men who are the greatest

*Read before the Alumni Society of the Dewey School of Orthodontia, Chicago, Ill., March 13, 14, 15, and 16, 1917.

factors in developing modern orthodontia, realizing the enormity of the subject, are insisting that orthodontia is a specialty in the field of dentistry, requiring special training and equipment for its successful performance.

This is the child age. Never before in the history of the world has there been so much serious thought devoted to the care and development of child life. In every development of organized society there are those who are interesting themselves in the welfare of the child. Educators and scientists are exerting their energies to the mental and physical development of the child. Orthodontia is recognized as a material factor in both.

Everybody is interested in this new science. The public confidence in orthodontia can by no other method be measured than by the success of the treatment attending it. The appreciation of orthodontia, then, is in direct proportion to the success or failure of the men performing the service. In many communities orthodontic appreciation is rapidly developing, while in others, I do believe on account of the character of work already performed, this appreciation will be long deferred.

European Orthodontia Society

My Dear Fellow Members!

Two and a half years have almost passed since we had our last, very successful, meeting!

Hardly could one at that time have believed that we would be obliged to postpone our next meeting so long,—but the terrible war which, since this time, has been devastating Europe, naturally makes international professional meetings impossible.

Still the science of orthodontia, in its modification, has made enormous progress in all the different belligerent countries and has proved to be an absolutely indispensable and much needed help in war-surgery, in the treatment of facial wounded soldiers, and it is most gratifying to dental science in general, but to orthodontia in special, that so many human beings, otherwise spoiled for their whole life have, through our art and by our professional brothers, been treated and cured.

Together with our most sincere wishes for you and yours for the coming new year, we express the hope that the interest in our science, when peace is restored, will be strong enough to bring in all our members together again, joined in earnest work for the progress of orthodontia, to the benefit of mankind!—Cordially yours, G. Lind, President E. O. S., Keizersgracht 542, Amsterdam, Holland.

New Year, 1917

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

James David McCoy, D.D.S., Editor,
Los Angeles, Calif.

A CONSIDERATION OF SOME PHASES OF X-RAY MACHINE CONSTRUCTION FROM AN ENGINEERING STANDPOINT

By J. B. Wantz, E.E., M.E., Chicago, Ill.

SOME time ago, an article entitled "The Price of Progress" was published in the *Interstate Medical Journal.* This article showed how the rapid developments in the field of roentgenology cost the medical profession and the manufacturers great sums of money. In the case of the doctor, this cost was due to the fact, that, before a first class machine had become at all impaired through use, it was so far out of date, that the doctor was forced to purchase a new one. As can be readily understood, the loss of money the doctor suffered was due to no defect of the machine itself, nor was it due to some fault of the manufacturer, but was caused only by the rapid progress of the art, and the author, therefore, rather aptly called this "The Price of Progress."

The money paid out in this way brought a tangible advance in the method of using and generating the x-rays. In other words, the advantages of a certain amount of knowledge were obtained by the spending of this money. This knowledge, once gained and paid for, is not the property of the individual, but of the world at large, and it should be so considered.

Engineering in its broadest sense is the application of known facts and principles to new problems. Dental radiography is, comparatively speaking, a new science. Its importance is such that a prominent professor of dentistry recently said. "I would buy an x-ray outfit if I had to mortgage my office to do it." Fortunately, dental radiography is very closely allied to general radiography, as employed by the medical profession. The latter is already well beyond its infancy, and is, in fact, a recognized and respected branch of medical practice. Looking then at dental radiography from the viewpoint of an engineer, what would be more natural than to apply the principles and methods learned in general radiography to dental radiography. The "Price of Progress" in general radiography has already been paid—knowledge has been gained. What is more natural than to apply this knowledge to a science so closely related to the one in whose development the knowledge was acquired.

From an economical and an engineering standpoint, then, it is but natural to expect that the manufacturers, in designing machinery for this new purpose, would bear in mind the knowledge and experience so dearly bought in their old field of endeavor. One has but to look through the catalogues of some of the manufacturers of x-ray equipment for dentists to know that the answer in

many cases must be "No." Whether through a desire to exploit this virgin field, whether through a wish to unload old apparatus, or whether through inexcusable ignorance will in the end make little difference. A retrogression in the class of machines advertised is apparent, both from the economical and the engineering standpoint. It is safe to say, then, that if these machines are sold, the dental profession will be forced universally to pay the "Price of Progress" for knowledge which the world already possesses.

There are machines advertised which consist of an induction coil with a fixed primary winding, a single point "self-adjusting" electrolytic interrupter, a fixed resistance supposed to "regulate the tube current gradually," a milliamperemeter, and a valve tube. The milliamperemeter is the only piece of apparatus in this entire machine which is applicable to a modern x-ray generator.

The induction coil with a fixed primary winding has been discarded by all manufacturers of x-ray apparatus for the medical profession, for all machines except some of the very smallest. A catalogue, issued by a once prominent x-ray coil manufacturer in 1907, fails to show a single coil with a fixed primary winding, although twenty-six outfits are listed.

The type of interrupter, advertised as a "self-adjusting" electrolytic interrupter, has not been used by any large manufacturer since about 1905, on account of the necessity of controlling the amount of current admitted to the apparatus by the variation of the amount of the electrode point exposed to the action of an electrolyte. An interrupter of this general design is described in a catalogue issued in 1907. There is, however, a method of controlling the amount of the point exposed in that interrupter, which is not the case in the interrupter in question. The description in the catalogue states that this improvement (the method of controlling the amount of the point exposed) was one of the things which made the interrupter practical. The use of the interrupter direct on alternating current is also "taboo" with most responsible manufacturers, as, in nearly all cases, rectifiers are listed with alternating current outfits.

The amount of energy transmitted to the apparatus can, as before mentioned, be controlled by the area of the surface of the interrupter point exposed to the action of the electrolyte. On all machines, since practically 1900, another means of control was provided; namely, a rheostat by which a more refined and gradual control was possible. In all cases, however, some resistance was always left in circuit. This resistance acted to limit the current when a very soft tube was used. Without it, the tube would "pull" enough energy to destroy itself. The fixed resistance then acts only as a current limiting device, and therefore could not be used to "reduce the current so that the x-ray tube............. may be regulated gradually" as the advertisers so blithely state of their "resistance unit."

When an x-ray tube, energized by a coil, begins to show "inverse," it is a sign that the tube is too soft for the voltage impressed across it; that is, the resistance of the tube is so low, that the electromotive force, generated by the make of the primary circuit, is great enough to force current through the tube in the wrong direction. The proper and standard remedy for this is to cut in more inductance,—decrease the ratio of transformation, by putting more pri-

mary turns in circuit. This procedure will lower the potential delivered by the coil, so that the electromotive force, induced in the secondary at the make, is no longer great enough to force current through the tube.

Now, if the coil is one in which there is no possibility of changing the ratio of transformation,—in other words, if the coil has no inductance switch,—there is no possibility of eliminating inverse by this method. There is, then, only one method left—the valve tube.

Theoretically, the valve tube is a good thing. Practically, it is not.. A gas-filled x-ray tube, as all radiographers know, has a vacuum which must be frequently adjusted. The valve tube, too, has this self-same vacuum, and, in order to operate efficiently, must be adjusted very exactly. The radiographer, by using a valve tube, greatly increases his own troubles and complicates the operation of his apparatus.

As far back as 1907, valve tubes were not in great demand among the members of the medical profession. In fact, a catalogue of a prominent manufacturer, dated June, 1907, and dealing altogether with x-ray apparatus, fails to say a word about valve tubes, although twelve of its thirty pages deal exclusively with induction coils and coil accessories.

Another catalogue, of one of the largest coil manufacturing companies in the world, lists nineteen coil outfits, only four of which are equipped with valve tubes, and these four outfits are equipped with *triple* valves, in addition to the inductance switch, merely as an extra guard against inverse. The coil in question, however, has only a single valve to ward off inverse.

Now, if we trace the development of the induction coil, we see in it a perpetual fight against inverse. First, the series spark gap, then the valve tube, and last of all, the inductance switch, mark epochs in the struggle. The final product of this long period of development is, *on direct current,* a machine to be reckoned with. It is a coil with a potential high enough to break down a twelve inch air gap and with enough iron in the magnetic circuit and enough copper in the electrical circuit to make a large milliampere output possible. An inductance switch of at least four or five steps is always provided. The interrupter is either one of the gas-filled, mercury-turbine variety, or it is a multiple-point, electrolytic break with devices for making very close adjustments of the points possible.

The rheostat, too, shows the result of evolution in that instead of being merely any old regulating resistance, it is a rheostat of special design, with a great many points, and capable of running long periods with a high energy output without overheating. On alternating current, however, even this coil cannot do the work because of the necessity of rectifying elements and their attendant troubles.

As mentioned before, this type of coil is a very capable piece of apparatus on a direct current, but then *only* when it is in the hands of an experienced operator. You have three points of control to set or to operate when running the machine; namely, the inductance switch, the interrupter, and the rheostat.

On the modern x-ray machine,—the Interrupterless—there is merely a rheostat to be set. The result is that with a modern equipment, the operator has to spend a great deal less of his time and thought in the mere mechanical

act of operating his machine, and will, therefore, have more of his time to devote to the serious part of his business,—the patient.

This ease of operation is entirely due to the fact that this modern machine develops no inverse and needs no interrupter, because the current energizing it is alternating in character. This last fact is one drawback to this type of machine; when the service current is direct, it is necessary to provide each machine with a rotary converter of large capacity to change this current to alternating, but the simplicity of operation is still there.

The Interrupterless is, then, speaking in general, the real x-ray generator. With this in mind, it can be readily seen that if the manufacturers have enough foresight to apply the knowledge, which the "Price of Progress" has purchased for them, then the Interrupterless is the machine to be used in dental radiography.

As the field of dental radiography is new, new conditions will be found and, no doubt, a new machine, for this particular purpose, will be developed. If this is the case, by all means let the Interrupterless be the groundwork, for in it we have a sure foundation, proved by experience. To go back to the induction coil, is retrogression,—is an attempt to halt the march of progress; worse still, it is a disregard of all engineering principles, and those unfortunate enough to be misled by the selling patter of the wily agent will again be called upon to pay the "Price of Progress."

The International Journal of Orthodontia

PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 801-807 Metropolitan Bldg., St. Louis, Mo.

Foreign Depots—*Great Britain*—Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

Subscription Rates—Single Copies, 30 cents. To anywhere in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $3.00 per year in advance. Under foreign postage, $3.40. English price: 15/ per annum, 1/6 per number. Volume begins with January and ends with December of each year.

Remittances—Remittances for subscriptions should be made by check, draft, postoffice or express money order, or registered letter, payable to the publishers, The C. V. Mosby Company.

Contributions—The editor will be pleased to consider the publication of original communications of merit on orthodontic and allied subjects, which must be contributed solely to this journal.

Opinions—Neither the editor nor the publisher hold themselves responsible for the opinions of contributors, nor are they responsible for other than editorial statements.

Reprints—Since it is not desirable to hold type standing longer than absolutely necessary, all requests for reprints should be made at time of submitting manuscript for publication. Rate card will be sent with galley proof.

Communications—Contributed articles, illustrations, letters, books for review, and all other matter pertaining to the editorial department should be addressed to the Editor, Doctor Martin Dewey, 25 East Washington Street, Chicago, Ill. All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 801-807 Metropolitan Building, St. Louis, Mo.

Illustrations—Such halftones and zinc etchings as in the judgment of the editor are necessary to illustrate articles will be furnished when photographs or drawings are supplied by the authors of said articles.

Advertisements—Objectionable advertisements will not be accepted for publication in this journal. Forms close first of month preceding date of issue. Advertising rates and sizes on application.

Change of Address—The publishers should be advised of change of subscriber's address about fifteen days before date of issue, with both new and old addresses given.

Nonreceipt of Copies—Complaints for nonreceipt of copies or requests for extra numbers must be received on or before the fifteenth of the month of publication; otherwise the supply is apt to be exhausted.

Entered at the Post Office at St. Louis, Mo., as Second-Class Matter

EDITORIALS

The Efficiency of the Lingual Arch as a Regulating Appliance

IN previous issues of this journal (Nos. 10 and 11, Vol. II) we published two articles on the lingual arch as used by Dr. Lloyd S. Lourie, of Chicago. In this issue of the journal we are publishing a short description of the technic of the lingual arch as used by Dr. John V. Mershon, of the Thomas W. Evans Museum and Dental Institute School of Dentistry University of Pennsylvania. That we have faith in the possibilities and efficiency of the lingual arch goes without saying, or we would not devote so much space and time to this appliance. The policy of the *International Journal of Orthodontia* has always been to give its readers such articles as we believe have some practical value, either to the man engaged in the practice of orthodontia as a specialty, or the man who is compelled to do orthodontia with his general practice. We are publishing these articles on the use of the lingual arch because we believe they will be of particular benefit to the men engaged in the practice of orthodontia as a specialty, for the use of

the lingual arch is radically different from anything that has been employed as a regulating appliance up to the present time. Neither Lourie nor Mershon claim to have discovered the lingual arch, because if one will go back through the literature of orthodontia he will find the lingual arch has been used as a retaining appliance by a number of men, and certain forms of the lingual arch have even been on the market for a number of years. We may also state that the principal feature of the Jackson appliance consists of a removable lingual arch, and the fact that it does consist of removable spring lingual arch has been the great factor in keeping it before the dental profession for a number of years, even though it has been compelled to receive a large amount of adverse criticism.

Various types of lingual arches have also been used as retaining appliances for a number of years, and have been so described in a number of textbooks. The possibility of stretching a lingual retaining appliance by the use of the wire stretchers was realized by Angle which is proved by the fact that he placed upon the market an instrument for stretching wire by means of pinching, which was designed for increasing the stress upon teeth after the retaining appliances have been adjusted. He also recommended the use of the wire stretchers in pinching a wire placed between deciduous canines for the purpose of expanding the dental arch in the treatment of early cases of malocclusion. This was about the extent of the use of the wire stretching pliers which Angle suggested when used in conjunction with the lingual arch, and during the last few years none of his writings have been devoted to the wire stretching pliers used in conjunction with the lingual arch as an extensive regulating appliance.

The use of the lingual arch as advocated by Lourie is by no means an experiment, for he has been using this method for over twelve years. His first clinic on the use of the lingual arch as a regulating appliance in conjunction with the wire stretchers was before the American Society of Othodontists at the meeting which was held in Chicago in 1905. Since that time he has been increasing the use of the lingual arch in his practice, until at the present time, in his hands the appliance is a positive proposition and one which possesses many advantages. We also learn from Mershon that he has been using a lingual arch for over eight years with very satisfactory results, and at the present time the lingual arch as described in this issue is the principal regulating appliance which he uses. From observation of Mershon's patients, as a result of spending two days in his office, we would make the statement that he uses lingual appliances in at least ninety per cent of the cases, and ninety per cent is a very conservative estimate from what we have seen in his practice. A very pleasing feature in regard to the work done by Lourie and Mershon is the fact that they have used their appliance extensively for a number of years before they rushed into print describing what a wonderful mechanism they had discovered. As a result of years of careful and painstaking effort in using it in their own practice, they have now reached the point where they are able to make positive and definite statements in regard to what the appliance will do, and how it should be used. This is exactly opposite to some of the things we have seen in the last few years in regard to a number of inventors and manufacturers who have designed appliances in laboratories, have rushed into print with large commercialized articles telling the wonderful benefits to be derived from their appliance,

and as a matter of fact, they have never tried the appliance out in practical use, and it has been used experimentally only on a few isolated cases, still the appliances have been published as a complete device before the ink is hardly dry on the patent sheet issued by the patent office. It is therefore a great thing for the science of orthodontia that there are a few men who are working for the advancement of the science to such an extent that they are willing and conscientious enough to try out the results of their experiments, to be satisfied with those results in their own minds, and then give the orthodontic world the result of the years of their efforts and research in the technic with a description of an appliance which is an actuality and not a laboratory experiment. We realize that there has been a great tendency for the American people, as a whole, even dentists and physicians, to rush into print with wonderful discoveries before they have been worked out. We remember several years ago of reading of Sir Richard McEwen, of Glasgow, Scotland, who worked twenty-two years upon the question of bone development before he published the result of his research. We have always appreciated McEwen, and we also appreciate Lourie and Mershon; they have been able and conscientious enough to work a number of years in a quiet unassuming manner upon a regulating appliance which we believe at the present time is far superior to anything that has ever been given to the profession. Therefore in publishing the results of the use of the lingual arch in advocating its use to our readers we can do so without the least bit of hesitancy, for we are positive and certain of what this appliance will do because these men, who have tried this appliance, are men of their word, and we have seen the results of the use of this appliance in a great many cases.

We have stated before that the articles on the use of the lingual arch were intended primarily for men engaged in the practice of orthodontia for we have observed as a result of conversation and traveling and visiting in the offices, that the use of the lingual arch as a regulating appliance is very poorly understood. During the past six months we have visited a large number of offices in all parts of the United States, and find that very few men are familiar with the possibility of the lingual arch, or at least they are not able to accomplish such results as are accomplished by Lourie and Mershon. We find the majority of the best men who have been engaged in the practice of orthodontia a number of years admit the desirability of an appliance which embodies the essential features of the lingual arch. The advantages of this appliance can be very readily seen by those who have been familiar with the use of the labial arch, those who are familiar with such appliances as necessitate the banding of a large number of teeth, the construction of complicated mechanical attachments which make an appliance very conspicuous and render the patient a suitable advertisement for a hardware store, or a walking advertisement for some manufacturer of a regulating appliance. The inconspicuousness of the lingual arch appeals to patients, and as a result of this it is going to force itself upon the orthodontic profession regardless of whether men accept it or try to reject it as something that is useless, because it does not carry a patent and contribute to the royalty of some manufacturing concern.

There is no other appliance, with the exception of Jackson's appliance, which is so little controlled by manufacturing concerns, and no other appliances,

except those mentioned, that place the operator so little in control of the dental supply house, the holder of process patents and appliance patents, as the lingual arch, as has been described in various issues of the *International Journal of Orthodontia.* It is a pleasing fact to know that orthodontia can now rest as a science absolutely beyond the control of manufacturing interests and beyond the control of those who have appliance patents, for the use of the lingual arch rests entirely upon the ability of the operator to use and construct the appliance.

We have already mentioned the desirability of the appliance from an inconspicuous standpoint, and the appliance if properly constructed, is one that exerts force upon the teeth in such a manner as to produce no pain or inconvenience. The teeth can be moved by the use of the lingual arch with absolutely no pain. If any pain is encountered in the use of this appliance it is because of faulty technic and improper construction and wrong application of force. While the appliance possesses great possibilities, there is no appliance with which we are familiar that is capable of producing more harm or undesirable results than if used by one who is not versed in the mechanical principles and familiar with the action of light, small gauge wires acting with a continuous spring force or with a force produced by the wire stretching pliers.

As a result of the observation of cases treated in the practice of Lourie and Mershon we can unhesitatingly recommend the lingual arch to our readers as being an appliance which possesses all the possibilities which they claim for it, and which is capable of doing all the things they claim it will do, and in the manner in which they claim they can be accomplished and one which possesses more ideal requirements, if used by a man who understands its mechanical possibilities, than any other appliance with which we are familiar.

The Liability of Damage Suits in the Practice of Orthodontia

IT is a well known fact that the practice of any branch of medicine, surgery, or dentistry renders the practitioner liable to damage suits in a large number of instances. There is a certain class of lawyers who believe that the medical profession is always at fault, and who, upon the least possible pretense, try to establish damage suits.

Up to the present time those engaged in the practice of orthodontia have been quite free from damage suits, but this has been due to good fortune and not to the fact that the bringing of suits has been impossible. There is no branch of medicine or dentistry that is more liable to damage suits than is orthodontia. It is more liable at the present time than it has been at any time past, owing to the fact that there seems to be a very energetic movement among a certain class of lawyers in different localities to bring damage suits against the medical and dental professions.

At the present time, in a number of cities, damage suits have been filed against dentists for the improper treatment of root canals. This has been brought about, of course, by the present agitation among the medical and dental professions regarding the systemic effects of improperly filled root canals. These

damage suits have also been given impetus because of the different methods advocated for filling root canals. These methods have been severely criticized by the profession's own members, and a great many men have been prone to criticize every method except their own favorite one. Many men in the dental profession have unconsciously and unwisely made remarks in regard to the methods that have been employed by other operators with the result that patients have taken those remarks to a lawyer who has immediately begun a damage suit, which is a very disagreeable and unpleasant proposition to be compelled to defend, even if the suit is unjust and one which probably will be thrown out of court, or decided in favor of the defendant when it comes to trial.

Considering the large number of suits that are being filed against the dental profession at the present time, it is only wise that we should remember the possibility of suits being filed against practitioners of orthodontia. As we have said before, there is no branch of dentistry in which suits can be more easily filed than in the practice of orthodontia. There are so many conditions which may arise during the process of orthodontic treatment which can not be foretold in the beginning, that if the case should fall into the hands of a disreputable lawyer, or at least a lawyer who is prone to file damage suits, a great amount of trouble could be caused a large number of practitioners of orthodontia. To illustrate a few of the conditions which may be made bases for damage suits we need only to call attention to the fact that in the mouths of some patients there is a great tendency for the gingival tissue to become inflamed during the process of treatment. Every orthodontist has seen mouths in which a slight irritation from the appliance will cause the gingival tissue to become inflamed and hypertrophied. In a great many instances this inflammation and hypertrophy may have existed before the treatment of the malocclusion was begun. However, if the parent is not advised of this condition, after the case has been under treatment for some time, some dentist sees the patient and calls the parent's attention to the inflamed gingival gum tissue; he may suggest the possibility of a damage suit, or he may suggest that the treatment is being improperly conducted, which results in the parent seeking the advice of a lawyer. Or some lawyer gets the information that some dentist is criticizing the orthodontist's work, and the result is a damage suit is filed. This hypertrophied gingival tissue may have existed before the treatment was begun; and if it has been caused by the appliance, it is nothing which is serious and can not be easily eliminated; and it is certainly no basis for a damage suit. Another phase of this subject is the fact that in some of these cases of hypertrophied gum tissue the patient may fall into the hands of some dentist who tells the patient he has a malignant tumor, and very cunningly removes the tissue; a damage suit is filed as a result. The hypertrophied gum tissue having been removed, there is no evidence to prove that a malignant tumor did not exist, and testimony to the contrary will probably receive very little weight in court, for it is a well known fact that the majority of juries look upon expert testimony as very unreliable. Expert testimony and evidence will prove that children of an orthodontic age are not prone to have malignant tumors, nevertheless, it is very easy for a lawyer to so describe a condition that he can convince a jury that the child did have a malignant tumor, and that the tumor was caused by the regulating appliance.

Another condition which will arise is the decay of the permanent teeth. During the past few years a great amount of attention has been given, and many articles have been written, in regard to the possibility of orthodontic appliances causing decay of the teeth. While there is probably no question but that teeth will decay during orthodontic treatment, it is also a well known fact that the teeth of children who never have had regulating appliances in their mouths are prone to decay. Therefore at the beginning of the treatment of a case of malocclusion, the teeth should be carefully examined for caries; a chart should be made showing what teeth are decayed and filled at the time the treatment is begun. The teeth should receive a careful prophylactic treatment and examination, and if there are any white spots on the surfaces of the teeth, they should be carefully noted and the parent's attention directed to them, to avoid the possibility of spots which existed before treatment being attributed to the treatment after it is begun. The use of bands and ligatures upon teeth offer a very satisfactory excuse for their decay. If a tooth has had a band on, or if a tooth is in contact with a band, and caries occurs in either one of these teeth, it is very hard to make the parent and some dentists believe the decay is the result of normal conditions and has not been caused by the band; likewise if ligatures are used upon teeth and the proximal surface of teeth decays, it is easy for some men to believe or state that the ligature has caused the decay of the tooth, when, as a matter of fact, the largest amount of caries found in teeth appears on the proximal surface although they may never have had ligatures upon them. We have seen the decay of teeth that have had regulating appliances on them, but this does not prove that the appliance has been the direct cause of the decay; however some record must be kept of the number of decayed teeth at the beginning of treatment as a means of protection.

The number of teeth that are devitalized at the beginning of treatment should also be recorded, for the possibility of trouble from a devitalized tooth must be borne in mind. If a devitalized tooth should give trouble during orthodontic treatment, the trouble would be laid to the treatment, while in fact most devitalized teeth give trouble without any orthodontic treatment being instituted.

Probably in times past a number of teeth have been devitalized during orthodontic treatment, but the cases where it actually has occurred have been very few. Up to the present time we do not know of any damage suits having been filed against orthodontists for the devitalization of teeth, nevertheless it is a condition which would cause a great amount of trouble if it fell into the hands of an unscrupulous lawyer.

It must also be remembered that a certain number of pulps die in teeth without any cause so far as is known; also that pulps die in teeth as the result of blows, and experience has also taught us that patients with regulating appliances are not immune to blows upon the teeth.. In a great many instances patients come back with stories of the regulating appliances having been knocked out of their mouths, lost in play, and even some go so far as to have them kicked out. Therefore, if the teeth are subjected to all of those external violences during the wearing of regulating appliances, it is not unreasonable to believe if the pulp dies, that the external violence may have had as much to do with it, or more than the orthodontic treatment.

Another condition which has been called to our attention is the fact that the roots of some teeth are shorter than normal; that the roots of some teeth fail to develop or seem to be absorbed sometime during the life of the individual. Whether orthodontic treatment has ever caused destruction of a root of a tooth we do not know, but radiographs have been shown, taken of teeth during orthodontic treatment, in which the roots of certain teeth were imperfectly developed. It is, therefore, wise in the beginning of all orthodontic treatment to have radiographs made of all the teeth in order to show the condition of the roots at the time the treatment was begun and to be able to prove that certain conditions have not occurred which might be attributed to the treatment if radiographs of conditions before treatment was instituted can not be shown as evidence.

Another though lesser factor which may enter into suits, either damage suits or civil suits, is the fact that a great many orthodontists in times past have been prone to definitely promise their patients a great many things which they only hoped would occur. Some men have gone so far as to promise that the correction of the malocclusion would improve the patient's breathing, or in other words would change a mouth breather into a normal breather. While clinical evidence shows that orthodontic treatment, in the majority of cases, will improve the breathing, and in some cases, will change the mouth breathers to normal breathers, nevertheless it is not a wise thing to make a positive statement to a parent that such a thing will occur. Clinical evidence also shows that orthodontic treatment improves the general health of the individual, and as a result of this we believe that a child who is underfed, undernourished, and poorly developed will have his general health improved as the result of orthodontic treatment. But such a result should not be guaranteed, it should not be promised positively, but should only be stated as a belief. Again, some men have always promised a result which will be "normal occlusion" or "perfect occlusion." In the majority of cases we again say that a normal occlusion, or what is called a perfect occlusion, can be obtained; but we also know that there are a certain number of cases, which, because of malformed teeth, the irregularity in the size of the teeth, and other conditions which might be mentioned, render the establishment of normal occlusion impossible. Because of these things we caution orthodontists against making positive promises, and suggest that they only outline, in a general way, the benefits to be expected, stating that if the case responds as other cases have, certain benefits may be expected.

Again, we find that remarks of orthodontists in criticizing the work of someone else may very often be the cause of a damage suit. We have known men who have begun a certain line of treatment for the correction of a malocclusion; the patient, traveling to some other part of the country, has fallen into the hands of another orthodontist, and the second orthodontist has very severely criticized the treatment as outlined by the first man. In the first place, severely critizing another man's work is a very unethical thing to do because the probabilities are that the man who first began the treatment was more familiar with conditions, more familiar with the environment of the patient than the man who saw the patient after the appliances were on the teeth. Not only is it unethical to criticize the work of a fellow orthodontist in such a manner, but it is very indiscreet to do so, for these remarks may be made the basis of a damage suit.

We have even heard some orthodontists go so far as to tell the patient that any man who follows that kind of treatment should be placed in jail, or should not be allowed to practice orthodontia. While in the majority of cases the patients are broadminded enough not to consider these remarks, however, there are certain patients who would if they had the proper legal advice, immediately file damage suits against the first man, based upon the remarks of the second. As a matter of fact, the man who began the case is probably more capable than the man who criticized.

Criticizing a certain appliance as seen in the mouths of patients is also very unprofessional and unethical, and also may lead to damage suits for which the orthodontist is responsible. There is a responsibility which one orthodontist has to another from an ethical standpoint, also a responsibility which one man has to another, which might be termed a "safety-first" move. In other words, an orthodontist who unwisely criticizes the plan or the treatment of another orthodontist may simply be starting a damage suit, which may cause the same thing to happen to him in return. This is what may be brought about by unwise statements given carelessly by some orthodontist. The responsibility of one orthodontist to another, so far as damage suits are concerned, can be avoided if men will simply be ethical, show the professional spirit which they should show, and not criticize each other.

In calling attention to the liability of damage suits which may be filed against orthodontists, it is only fair that we should state that every man engaged in the practice of orthodontia should take every possible step to protect himself against these conditions, because one can never tell when a suit will be filed. As a preparedness measure, orthodontists should take out liability insurance with some reliable concern, because nothing discourages the filing of damage suits by shyster lawyers so much as to know they will be compelled to fight an insurance company that has an array of legal talent always ready to meet such emergencies. In the spirit of today, first be careful, and second be prepared.

A Mess of Pottage

WE remember a certain distinguished individual in ancient history who was supposed to have traded his birthright for a mess of pottage. Because of a certain condition existing in the dental profession today we are led to stop and ask the question whether the dental profession is not selling its birthright, in a great many instances, for a mess of pottage.

We have upon our desk today three different lots of advertising literature which have been sent to us by different concerns. If we should follow out the suggestions made in those advertisements, we would be like the gentleman of old in trading our birthright for a mess of pottage. We are referring particularly at the present time to the large amount of free literature of an advertising nature which is sent the dental profession advocating the wonderful virtues and properties of certain tooth pastes, mouth washes, and similar dentifrices. When we first graduated from dental college we supposed it was a compliment to have a manufacturing concern offer to send us free samples, for we believed

they were recognizing our scientific ability in asking us to recommend their preparations to our patients, and we were flattered to believe that they thought we were scientific enough that our opinion would have some weight with the public, and some weight with them in manufacturing those articles. As we grew older and wiser in the ways of the world, we observed it was not a question of flattery, but the sending of this literature to us offering to send us free samples was nothing more than a question of a bribe, a legitimate form of graft, and an insult to our intelligence. In each one of these circular letters, which came with a two cent stamp on it, we are informed that the tooth paste or mouth wash possesses all the necessary requirements that any such article should possess. We are even given a line of "talk" which we should give our patients recommending this particular article, and we are informed that the same has antiseptic properties which will heal diseased gums, tighten loose teeth, and do a large number of other things which might be supposed to be desirable in a large number of cases.

While some of these mouth washes and tooth pastes may possess antiseptic properties, the question may arise as to whether an antiseptic mouth wash or a tooth paste is desired by all people. In other words, does every mouth desire an antiseptic tooth paste; does every mouth desire a mouth wash which is supposed to tighten the teeth and make the gums hard? Suppose there is no need for an antiseptic mouth wash or preparation which will harden the gums. Then what is going to be the effect of the continued use of such a preparation? We are also informed that a number of these tooth pastes possess no grit, are very delightful and pleasing to the taste. The latter part of this seems to be the greatest argument in favor of tooth paste, because we find the majority of individuals select a mouth wash or a tooth paste which is agreeable to the taste. If they possess that feature, this is the only thing that the general public thinks is necessary in dentifrices.

In regard to the dental profession trading its birthright for a mess of pottage, we have learned in conversation with a number of dentists that they always recommend a tooth paste and mouth wash which some energetic company succeeds in keeping them supplied with. In other words, the patient asks the dentist about a tooth paste and he always recommends the tooth paste of which he happens to have a number of samples. When they run out of samples they simply fill out an enclosed post card, send to the manufacturer, and the manufacturer is commercial and wise enough to keep the dentist supplied with a quantity of his tooth paste, thereby getting the dentist to act as a free advertising bureau for his article which may possess some virtue and which may not. As a further insult to the intelligence of the dental profession, the majority of these manufacturers of dental preparations enclose blank prescription forms by which it is only necessary for the dentist to sign his name, send the patient to the drug store with this aforesaid standardized prescription blank to obtain the article which the manufacturer wishes the dentist to recommend to his patient. It is an insult to the intelligence of the dental profession by assuming that they have not enough intelligence to write a prescription for a mouth wash if the patient should want one. It is a further insult to the dental profession to assume that they do not know enough about pathological conditions to recommend a mouth

wash which is suitable for the particular individual case. It is further an insult to the intelligence of the dental profession to try to make them believe that any one particular mouth wash or tooth paste will be suitable to all mouths, and to all pathological conditions which are present in all individuals. It is equally a bad plan to suggest that any one particular mouth wash, which is suitable for pathological conditions, would be a desirable thing to use in the mouth of individuals that are in a healthy condition. In other words, it would be a bad thing to use a tooth paste or mouth wash which is suitable for a pathological condition of the gums in a mouth which simply requires a cleansing agent for cleaning the teeth, or in cleaning the teeth and the gum. It would be wrong to use an antiseptic and astringent mouth wash when simply a cleansing agent is required.

We are not saying that all tooth pastes and all mouth washes are useless; we are not claiming that they do not have particular virtues, but we do claim that the dental profession has enough intelligence to select the particular tooth paste or mouth wash indicated, and dentists should be allowed to recommend those dentifrices upon their own knowledge of the articles, and not because some energetic advertising manager of a manufacturing concern insists upon keeping them supplied with articles, and also insists upon keeping them supplied with prescription blanks, and an intelligent (?) line of conversation which they are supposed to give to their patients. We, therefore, believe it is time for the dental profession to pause and realize it has, in a great many instances, been made a tool for the furthering of some manufacturing interest, and as a result of that it has traded its birthright for a mess of pottage—or a lot of tooth paste.

The Pacific Coast Society of Orthodontists

THE Pacific Coast Society of Orthodontists, the only organization on the Pacific Coast devoted to the advancement of the science and art of orthodontia, held its annual meeting in San Francisco February 12 and 13, 1917. This was the fourth annual meeting since its organization, and a review of the work which the society has so far accomplished, constitutes the warranted justification for its existence as a factor in the further progress of orthodontia, as a specialty and in its bearing upon health problems.

To the pioneers in the field of orthodontia and to all those who during the past twenty-five years have preached the gospel of normal occlusion, the entire dental profession is, indeed, deeply indebted. The problems in that field which, so far, have been successfully unraveled have affected the trend of dental practice to an amazing extent. Orthodontia in its advancement has furthered the interests of operative and prosthetic dentistry almost as much as its own. Normal occlusion is the basis of rational orthodontia and similarly the unnegligible factor in conservative and restorative procedures. As a *sine qua non* in the permanency of dental restorations, the orthodontists' conception of normal intercuspal and mesio-distal relationships has been permanently affirmed.

Orthodontia has broadened out in the last two decades to such an extent as to embrace within its scope, in addition to the dynamics of tooth-movement

and anchorage, problems of general interest in the field of health conservation. It has a place among the sub-specialties of medicine commensurate with the character of the services it renders in its own and allied territories.

Orthodontia is a prophylactic power in its bearing upon the prevention and correction of abnormalities of the mouth and nose cavities and of the structures in relation thereto for if permitted to persist these abnormalities become in time the causative factors of disorders of the respiratory, digestive and nervous systems. It is not limited in its scope to the correction of dental and oral deformities for the purpose of beautifying the human face, commendable as that function may be. Its viewpoint is broader, encompassing a consideration of those forms of physical inefficiency traceable directly to oral deformities permitted to go untreated because of the laity's ignorance and to some extent the dental and medical professions' indifference. The chain of systemic developmental defects and pathologic states, directly traceable to post-nasa obstruction associated with mouth-breathing, offer a most eloquent and convincing proof that orthodontia embraces in its ministrations something more than the means of correcting visible dental and facial deformities. Children, the sufferers from these abnormalities, are mentally and physically below standard. They are not infrequently the victims of nervous disorders which stamp them as the idiots they need not permanently be and become the sufferers, because of neglected treatment along orthodontic lines, of such deep-seated and chronic infections as pulmonary tuberculosis. Again malpositions of the teeth are the cause of disturbances of digestion and assimilation and, furthermore, because of the part which they play as predisposing causes of dental caries and of destructive inflammations of the investing tissues, are, in no uncertain degree, at the bottom of the systemic manifestations which follow in the wake of these common dental diseases. From the restorative standpoint these conditions hold equally true, even though the profession at large does not as yet fully appreciate the pathological significance of operations carried out in partial or complete disregard of the principles of normal occlusion. A filling which does not restore mesio-distal and intercuspal relations is a menace to the life of its investing tissues, of those of its neighbors and perhaps of the entire complement of teeth, upper and lower. Empirical dentistry is the only kind of dentistry which disregards normal occlusion and in these days of intensified clinical and laboratory facilities, empiricism must be measured in terms of either ignorance, criminal negligence, or both.—*The Pacific Dental Gazette.*

American Institute of Dental Teachers

AT the last annual meeting of the American Institute of Dental Teachers, held at Philadelphia, Pa., January 23 to 25, 1917, the following officers were elected: President, Dr. John F. Biddle, 517 Arch Street, Pittsburgh, Pa.; Vice-President, Dr. A. W. Thornton, McGill University, Montreal, Que.; Secretary-Treasurer, Dr. Abram Hoffman, 529 Franklin Street, Buffalo, N. Y.; Executive Board, Dr. R. W. Bunting, Ann Arbor, Mich., Dr. A. D. Black, Chicago, Ill., and Dr. G. S. Millberry, San Francisco, Cal. The next annual meeting will be held January 29, 30 and 31, 1918. The place of meeting will be announced later.

Dr. James Grant Lane

As a frontispiece to this month's Journal we publish the photograph of the late Dr. James Grant Lane, of Philadelphia. In the death of Dr. Lane orthodontia unfortunately loses one of its most enthusiastic and capable workers.

Dr. Lane died from the effects of inhalation of gasoline fumes, near his home, 1727 Memorial Avenue, Philadelphia, on February 4, 1917. The night being cold, he had gone to his private garage, a short distance away, to take precautions against the freezing of the water in the radiator of his automobile. Some hours later Mrs. Lane awoke, to find her husband not returned. She went to the garage, found it locked, but through a mailing orifice in the door could see the body of her husband lying under the car. Officers who assisted her in gaining entrance had the body taken to the Presbyterian Hospital, where it was stated he had been dead for some time. From the position in which the body was found it is believed that Dr. Lane had attempted to make some slight repairs to the car's mechanism, and, lying close to the floor, the deadly gas thus rendered him unconscious, death following apparently without a struggle. The coroner's jury rendered a verdict of accidental death from petromortis.

Dr. Lane was born April 12, 1866, on a farm near Shirleysburg, Huntington County, Pa. His parents were the Rev. James R. Lane, a Dunkard bishop, and Catherine (Meyers) Lane. Dr. Lane received his early education in the public schools of his vicinity, after which he went to Juniata College, at Huntingdon. Following this for a time he worked in the office of Dr. Thomas Rhodes, of Cora, Pa., where he entered the dental department of the University of Pennsylvania, graduating therefrom in 1890. He was made a demonstrator of crown and bridge work in the same institution beginning with the session of 1892-93, and for over twenty-five years held various teaching positions with his Alma Mater, his final promotion there being to that of assistant professor of orthodontia. At the time of his death he was clinical professor of orthodontia at Hahnemann Medical College, having received that appointment during the session of 1915-16.

Upon graduation Dr. Lane opened an office on Powelton Avenue, near Thirty-eighth Street, Philadelphia. Later he practiced and had his residence at 829 North Fortieth Street. Several years ago he opened offices in the Perry Building, Philadelphia, where he practiced up to the time of his death.

Dr. Lane was what everyone who had ever known him or heard of him liked to call a "mechanical genius." His workshop, with its various lathes, machinery and tools, was a source of wonder and admiration to all who visited him. When a case needed an appliance extraordinary, he manufactured it; if special tools or instruments were needed, they also were devised. All of which gave him a manipulative skill and a creative ability that likely has not been surpassed by his peers. Many appliances and instruments found in the dental depots bear his name, while he also contributed several valuable inventions to articles in general use. It was this love for creating the unusual that led him, doubtless, to take up the science of orthodontia as a specialty, and which during the latter years of his practice he had brought to a remarkably successful standpoint.

As a society program attraction Dr. Lane was much sought after, for, as his hearers often would say, "Lane always tells us something." His pen, too, was

a facile one, as his many contributions to the literature of his profession will attest. Probably it was as an extemporaneous discusser of papers, however, that he appeared to greatest advantage at dental meetings. He seemed to have the desirable faculty of viewing a subject from every possible angle, and, while generous, was also fearless; he seemed, too, to forget nothing in the way of detail. If he failed to debate upon a particular phase of the subject, it was because he knew nothing about it, and usually said so. His popularity led, in 1908, to an invitation by various dental societies along the Western coast to pay them a visit, and members of those societies yet delight to tell of the enthusiasm with which he was received at hurriedly arranged meetings ranging from Los Angeles to Seattle.

When the Pennsylvania State Dental Society was reorganized several years ago on what has come to be known as the "Illinois plan," Dr. Lane was made Chairman of the Committee on Reorganization, and the present strength and success of that society are largely due to his unselfish and untiring efforts to bring into its fold every component dental society in the State.

Dr. Lane was a member of the National Dental Association, Pennsylvania State Dental Society (past president), Pennsylvania Association of Dental Surgeons (past president), Academy of Stomatology, Odontographic Society of West Philadelphia (past president), Dental Alumni Association of the University of Pennsylvania (past president), Eastern Association of Graduates of the Angle School of Orthodontia, and Philadelphia Alumni Chapter of Psi Omega (P. G. M.). A great many other societies had elected him to honorary membership. He was a Past Master of Philadelphia Lodge, No. 72, F. and A. M., which body conducted services at the grave.

Because of his genial disposition James G. Lane numbered among his friends all those whom he had met during a busy lifetime of teaching, practicing and society work. As a consequence his death came as a great shock and sorrow to a host of friends the country over. Those who were fortunate enough to be intimately and frequently associated with him suffer a loss that will always be keenly felt, for he occupied a place in their hearts that can never be filled by another.

Dr. Lane is survived by a widow, Mary Ellen (Bartholomew) Lane, formerly of Chester Valley, whom he married April 8, 1896, and by three daughters—Mary Bartholomew and Caroline Huddleson, aged 19, and Helen, aged 16.

Seventh Annual Meeting of Dewey School of Orthodontia

THE Seventh Annual Meeting of the Dewey School of Orthodontia was held at Hotel LaSalle in Chicago, March 13, 14, 15 and 16, 1917.

It was decided to hold the Eight Annual Meeting in Chicago in the month of April, 1918, the exact dates being left to the discretion of the executive meeting.

The following officers were elected for the ensuing year: President, J. W. Parsons, Huntington, W. Va.; Vice-President, T. E. Purcell, Kansas City, Mo.;

Secretary-Treasurer, D. S. Sterrett, Erie, Pa. The Executive Committee is composed of the following: Max Ernst, St. Paul, Minn.; Alexander Jones, Youngstown, Ohio; A. M. McCarty, Tulsa, Okla.

The official program of the meeting follows:

TUESDAY, MARCH 13th.

10:00 A. M.—President's Address, Dr. A. C. Gifford, Oshkosh, Wis.
11:00 A. M.—Reports and Election of Officers.
2:00 P. M.—Origin and Function of Peridental Membrane, Dr. Dewey.
3:30 P. M.—Change in Dental Laws to Provide for Registration of Orthodontists, Dr. T. E. Purcell, President Missouri State Board of Dental Examiners.
4:30 P. M.—Interpretation of Radiographs, Dr. L. E. Carter, San Diego, Cal.

WEDNESDAY, MARCH 14th.

9:30 A. M.—Orthodontic Appreciation, Dr. Oscar Busby, Marshall, Texas.
10:00 A. M.—The Deciduous Molars and Their Relation to the Development of the Jaws, Dr. Charles R. Baker.
11:00 A. M.—Why the General Dentist Should Not Practice Orthodontia, Dr. E. G. Weeks, Saginaw, Mich.
2:00 P. M.—New Pathology, Dr. M. N. Federspiel, Milwaukee, Wis.
3:00 P. M.—Paper and Clinic on Swaged Molar Bands, Dr. Dewey.
4:00 P. M.—Practical Application of Engineering Methods in Orthodontia, Mr. Gilbert D. Fish, Columbia University, New York.

THURSDAY, MARCH 15th.

9:00 A. M.—The Question of a Universal Appliance, Dr. Harry P. Beaser, Fresno, Cal.
10:00 A. M.—Prophylaxis and Its Relation to Orthodontia, Dr. H. C. Hartwig.
11:00 A. M.—Technic and Use of Plain Bands and Lingual Arch, Dr. J. V. Mershon, Philadelphia, Penn.
2:00 P. M.—Radiography and Its Relation to Orthodontia, Dr. W. A. Griffin, Vice-President of National Dental Association.
3:00 P. M.—Principles Involved in Applying Orthodontic Pressure, Dr. Varney E. Barnes, Cleveland, Ohio.
4:30 P. M.—Subject not announced, Dr. L. L. Barber, President of National Dental Association.

FRIDAY, MARCH 16th.

Clinics—Drs. Lourie, Dewey, Mershon, Barnes, Sterrett, Richardson, Johnson.

The Independent Dental Journal

THE article written by Professor Gies on "Independent Journalism Versus Trade Journalism in Dentistry," and published in the December, 1916, issue of the *Journal of the Allied Dental Societies* deserves to be widely read by dentists. Its appearance is most timely, and indicates that a new order of things is dawning in dentistry. Ten years ago there would have been no inspiration for the writing of such an article, and surely no medium in which it could have been published. Its appearance denotes the birth of new thought in dentistry, and indicates that in time dentistry, like the other learned professions, will have mediums that are not controlled by firms whose business it is to make profit out of the commercial side of dentistry.

Undoubtedly Patrick Henry's fiery speech on independence had much to do with the American colonies breaking away from England and establishing their independence. Let us hope that Professor Gies will be the Patrick Henry to American dentistry in its struggle to break away from trade journalism. When

one analyzes this situation and compares it with existing conditions in other professions, one is appalled and then amused that a great science like dentistry should have remained quiescent so long with reference to this condition. How long would the science of architecture stand for its journals being dominated and controlled by a firm or group of firms that engage in the manufacture of carpenter's or plumber's tools? How long would scientific chemistry stand for its journals being owned and controlled by the manufacturers of crude drugs, pharmaceuticals, or laboratory supplies? How long or how far would medicine progress if all the medical journals were owned and published by instrument and drug manufacturers? Your answers to these questions are an easy matter. In not one instance would either of the above sciences tolerate the dominance of their journals by trade influences. Then why should the dental profession stand for it?

Its pernicious influence is obvious at a glance. Like an autocratic form of government, it may be beneficial, and then again it may be harmful. Why give trade power over science? Science always rules trade. Why try to do the absolutely impossible by making a great science subservient to the whims of trade and commerce? Does the trade dental journal flourish because its subscription price is one dollar, or even sent gratis? If so, then the shame of the whole situation rests with the dentist. But experience proves that this is not the case. The dentists are as willing to pay for dental literature and pay what it is worth as any other profession. Dental books are priced just as high as medical books, and there is no objection on the part of the dentist to paying the publisher's price. When the *International Journal of Orthodontia* was started and its price put at three dollars, just three times that of any other dental journal in America at the time it was started, dire calamities were predicted for it because it was said the dentist would not pay more than one dollar for a journal. But the *International Journal of Orthodontia* has grown in subscriptions every month, and it has grown because it has rendered a service to its readers and charged a price that was in keeping with the services rendered. It is impossible to publish a journal similar to dental journals published in this country today and sell it for one dollar unless profit is made in other channels. A journal published at this price will not return the publisher in gross subscription income five cents a copy, and that will hardly pay for the paper. But when a dental manufacturer can carry from thirty to forty pages of his own advertising at composition and paper cost, that otherwise would cost from $1500 to $2000 a month, besides making profit on his outside advertising, he is willing to lose on his subscription department. But who pays for it in the end? It is not necessary to answer this question, its solution is too easy. The danger in trade dominated dental journals is the opportunity given a manufacturer to play horse with the members of the dental profession when this manufacturer has something to sell. His advantage is evident at a glance.

It is a demonstrated fact that a "little leaven leaventh the whole." The article of Professor Gies points the way to a new order of things. It may be long in coming, but its coming is assured.

The International Journal of Orthodontia

Editor: Martin Dewey, D.D.S., M.D.

VOL. III — ST. LOUIS, MAY, 1917 — NO. 5

ORIGINAL ARTICLES

THE DECIDUOUS MOLARS AND THEIR RELATION TO THE DEVELOPMENT OF THE JAWS*

BY CHARLES R. BAKER, D.D.S., EVANSTON, ILL.

TWO of the principal causes of malocclusion are the premature loss of the deciduous molars, and the too long retention of the deciduous molars. Dr. E. H. Angle, in speaking of the prolonged retention of deciduous teeth, states that "in this event the succeeding tooth will either be prevented from erupting, or it will be deflected into malocclusion." I am convinced that the too long retention of deciduous molars may exert a much more important influence on occlusion. I have been unable to find in any of the literature that I have examined on the subject of the development of the jaws and eruption of the teeth, any positive statement regarding the exact time the deciduous molars should be lost from the arches, or any plausible explanation of the adjustment of the space when the deciduous molars are replaced by bicuspids, which occupy much less mesio-distal space in the arches. One statement, credited to Blair in Brophy's "Oral Surgery" is to the effect that "the extra space is used partly by the permanent cuspids and partly by the first permanent molar moving forward." This may be the correct explanation, but it would seem more logical if both bicuspids and the cuspid erupted at the same time; but the first bicuspid normally erupts at the age of ten and the second bicuspid at eleven, at which time there is usually normal proximal contact between the bicuspids and first molar, due probably to the pressure exerted by the developing second molar; so that it seems reasonable to believe that space is made for the increase in size of the permanent cuspid over that of the deciduous cuspid by a lateral growth of the jaw. In some cases the permanent cuspid erupts before either deciduous molar is lost, and assumes a normal position in the arch.

The deciduous first molars erupt in the average case at the age of two years, and the development of the roots is completed at the age of two and one-

*Read before the Alumni Society of the Dewey School of Orthodontia, Chicago, Ill., March 14, 1917.

half years. The deciduous second molars erupt in the average case at the age of two and one-half years, and the development of the roots is completed before the child is three years old. Absorption of the roots of the deciduous first molars begins at the age of seven and one-half years, and absorption of the roots of the deciduous second molars begins when the child is eight and one-half years.

In the normal development of the teeth and jaws, the permanent first molars easily assume their positions, to the distal of the deciduous second molars.

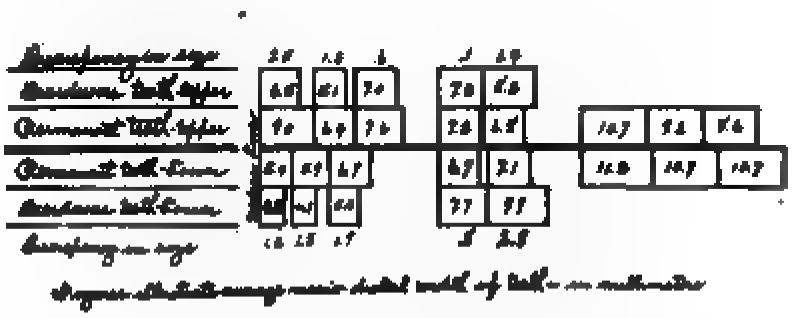


Fig 1.—Showing the relative mesio-distal widths of the deciduous and permanent teeth. (Sizes are taken from the table of averages as given in Dr. G. V. Black's "Dental Anatomy" and shown in millimeters.) Note that while the permanent incisors and cuspids are wider than the corresponding deciduous teeth, the bicuspids occupy less mesio-distal space than the deciduous molars.

The permanent incisors meet with practically no hindrance in their movements during eruption; they are wider mesio-distally than the deciduous incisors, but during the development of these teeth the jaws have increased in width in the incisor region to accommodate them, and the deciduous incisors have been lost, so that they are guided into position between the fully developed deciduous cuspids by the pressure of the tongue and lips. Let us compare the average mesio-distal width of the deciduous and permanent teeth as given in Black's "Dental Anatomy." (Fig. 1.)

It will be noted that there is a great discrepancy in size of the deciduous

Fig 2—Showing the average amount of development of the teeth at the age of ten when the first bicuspid is due to erupt.

molars and their successors, the bicuspids, and that in this case the permanent teeth are smaller mesio-distally than the deciduous teeth, while the reverse is true in the case of the incisors and cuspids. It will also be noted that while the permanent first molars and incisors assume their positions in the arch with comparative ease, the exchange of the deciduous molars for bicuspids is a much more complicated matter, for these changes take place between two areas that are occupied by fully developed teeth and well developed alveolar process. (Fig. 2.)

Unless the exchange from the deciduous molars to bicuspids is practically normal, the final occlusion will not be normal. Unless the upper and lower arches (each lateral half being considered separately) develop uniformly and harmoniously in the deciduous molar region, the result will be malocclusion, usually too great an over-bite of the upper anterior teeth. The extent of the

Fig. 3.—Both lower bicuspids, upper first bicuspid and upper deciduous second molar are in place. The permanent first molars occlude normally but the upper second deciduous molar occupies so much space that the upper first bicuspid and all of the teeth anterior to it are held in abnormal occlusion. This deciduous molar should have been removed from the arch as soon as the lower second bicuspid had fully erupted.

over-bite of the upper anterior teeth is one of the most important features of occlusion. Too great an over-bite will certainly prevent normal grinding of food by the bicuspids and molars; too short an over-bite will prevent normal incising of food, and in some cases indicate that the posterior teeth are abnormally elevated, or that there is a lack of development of the upper jaw.

Fig. 4.—Same number and kind of teeth in place as in Fig. 3, but in this case the first bicuspids are in normal occlusion and the upper deciduous second molar is producing malocclusion of the permanent molars.

An upper deciduous molar must be lost from the arch at approximately the same time that the corresponding lower deciduous molar is lost, or the result will be malocclusion. Normal occlusion can not be produced if there are deciduous molars in one jaw and bicuspids in the opposing jaw (on the same side of the mouth), for the teeth will not be of the proper mesio-distal width to harmonize. Under these circumstances, if there is proximal contact in both

arches, there will be malocclusion either anterior or posterior to the deciduous molar region. (Figs. 3, 4, 5 and 6.)

To have the final occlusion normal, it is necessary to have the dental arches harmonize in the deciduous molar region as to number and kind of teeth throughout the entire development of the arches; they must develop symmetrically. (Figs. 7, 8 and 9.)

The idea that all deciduous molars should be kept in the arches as long as possible is wrong. There is a definite time when each deciduous molar should be lost. It is important to keep the lower deciduous molars in the arch until the lower bicuspids are ready to erupt, but as soon as the lower first bicuspid erupts, the upper deciduous first molar should be removed from the arch. As soon as the lower second bicuspid erupts, the upper deciduous second molar should be removed from the arch. This will permit harmony in the size of the jaws as they develop. The upper deciduous molars should be removed at

Fig. 5.—Both upper bicuspids, lower first bicuspid and lower deciduous second molar are in place. First bicuspids occlude normally but the mesio-distal width of the lower deciduous second molar is maintaining malocclusion of the permanent molars.

Fig. 6.—This shows the lack of harmony in size in the deciduous molar region when both bicuspids are present in one jaw and both deciduous molars in the other.

Fig. 7.—Illustrating normal development in the deciduous molar region. Both upper and both lower deciduous molars are present and there is normal occlusion of permanent first molars, deciduous molars and cuspids.

the proper time regardless of the physical condition of the teeth themselves or the age of the patient. It is a matter of the relation of the individual tooth to the development of the jaws. In cases where both lower bicuspids have erupted and both upper deciduous molars are still in place, and the mesio-distal occlusion of the permanent first molars is normal (Fig. 10), the upper deciduous molars will occupy too much mesio-distal space to harmonize with that

Fig. 8.—The next step in normal development in the deciduous molar region. First bicuspids, second deciduous molars and permanent first molars in normal occlusion.

Fig. 9.—Normal occlusion, the result of normal development in the deciduous molar region.

occupied by the lower bicuspids, and as a result the upper anterior teeth will be held too far forward to occlude with the lower anterior teeth. This lack of occlusion during a period of rapid growth usually results in an elongation of both the upper and lower anterior teeth. All of the force of occlusion is sustained by the posterior teeth instead of being distributed over both entire arches, which tends to keep the bite of the posterior teeth short and increase the over-bite of the upper anterior teeth. Now, in this case, when the upper

deciduous molars are eventually lost and the bicuspids erupt, the mesio-distal position of the bicuspids will probably be normal, or nearly so, but the patient will still have the great over-bite of the upper anterior teeth—a serious form of malocclusion—and this condition might have been prevented by extracting the upper deciduous molars at the proper time. (Fig. 11.) In some cases, instead of holding the upper anterior teeth forward and away from the lower teeth, the pressure of the upper lip is sufficient to move the upper anterior

Fig. 10.—Both lower bicuspids and both upper deciduous molars are present and the permanent molars occlude normally. Note that the deciduous molars occupy so much mesio-distal space in the upper arch that the anterior teeth are held in malocclusion.

Fig. 11.—Showing the result of too long retention of the upper deciduous molars. The bicuspids and molars occlude practically as they should but there is a great overbite of the upper anterior teeth, a most unfortunate condition.

Fig. 12.—A form of malocclusion which may have been caused by the too long retention of upper deciduous molars.

teeth lingually, in which event there will be an overlapping of these teeth. (Figs. 12 and 13.) The too long retention of *one* of the upper deciduous molars, particularly the second molar, will produce the same form of malocclusion except that it will be less extensive. (Fig. 14.) This idea of mesio-distal harmony of the dental arches should be kept in mind during the treatment of all cases of malocclusion.

In regard to maintaining the space when a deciduous molar is lost prematurely: In the case of a lower deciduous molar, the space should be main-

tained until the bicuspid erupts, and the space maintained should be the mesio-distal width of the lost deciduous molar instead of the bicuspid that is expected, so as to harmonize with the corresponding upper deciduous molar. (Fig. 15.) When an upper deciduous molar is lost prematurely, or extracted after the eruption of the corresponding lower bicuspid, it is seldom necessary to maintain the space with an appliance, for the occlusion will usually keep the molars where they belong, and as the upper anterior teeth overhang the lower teeth, they can not move to the distal. However, in some cases the pressure of the

Fig 13.—Another view of the casts shown in Fig. 12.

Fig. 14.—Note that while the permanent molars are in normal occlusion, the upper deciduous second molar occupies so much mesio-distal space that all of the upper teeth anterior to it are held in malocclusion.

Fig. 15.—Showing malocclusion caused by the too early loss of the lower deciduous second molar. The space should have been maintained by means of an appliance until the second bicuspid erupted.

developing permanent upper second molar is sufficient to move the first molar mesially. Cases should be observed at frequent intervals and appliances used when they are required. I have found a simple appliance consisting of two plain bands connected by a wire bar very efficient. This is cemented in place, and the wire can be lengthened by pinching if additional space is needed.

Some men, who have recognized that something ought to be done to reduce the mesio-distal space maintained by a deciduous molar, and who have not felt the extraction of a perfectly good tooth justifiable, have ground away the mesial

and distal marginal ridges of the tooth. (Fig. 16.) This will allow the crowns of the approximating teeth to move closer together, but the wide-spread roots of the deciduous molar will still keep the roots of the teeth apart and give them an abnormal inclination. It will also make the extraction of the deciduous molar a more complicated operation at a later time.

Proper operative procedures should be administered to preserve the normal mesio-distal width of deciduous molars in case of caries. Regarding abscessed deciduous molars, Black says: "Chronic abscesses from deciduous teeth will often heal, following proper pulp treatment and root filling. In cases in which these abscesses can not be cured, the teeth should be extracted. It should be remembered that absorption of the root of a deciduous tooth does not occur if there is a chronic abscess, the activity of the absorption cells being prevented by the presence of the suppurative focus." However, in cases where the pulp

Fig. 16.—Indicates portions of tooth removed by grinding in order to reduce the mesio-distal width.

has been removed and the root canals filled, the absorption seems to proceed in a normal manner.

When the extraction of a deciduous molar is indicated, the operation should be carefully done to prevent injury to the developing bicuspid, which in most cases is located between the roots of the molar. In some cases, no doubt, bicuspids have been extracted unintentionally along with deciduous molars. The entire deciduous molar should be removed, including any small portions of the roots that may break during the operation, for frequently these fragments are not absorbed, and cause malocclusion by preventing normal proximal contact of teeth. When the extraction of a deciduous molar is indicated and there is any question as to the presence of a bicuspid to take its place, a radiograph is advisable.

In some mouths one or more of the bicuspids never develop. This fact is frequently indicated by the lack of occlusion of some of the deciduous molars,

that is, infra-occlusion, which would seem to indicate that in some cases the presence and development of the bicuspids are essential to the normal development of the alveolar process. Where infra-occlusion is noted, a radiograph should be obtained before making a diagnosis. (Figs. 17 and 18.)

In cases where a deciduous molar is retained in the arch and no bicuspid is present to replace it, a careful study of the occlusion should be made before determining the proper treatment.

I believe that the importance of the deciduous molars has been universally

Fig. 17.—In this case no lower second bicuspid developed

Fig. 18.—All of the bicuspids were absent in this case. Note the lack of occlusion of the deciduous molars.

overlooked or misunderstood, and that they exert more influence on the occlusion of all of the permanent teeth than do any other teeth. When they are moved, in correcting malocclusion, and too much absorption of their roots has not occurred, the bicuspids are usually moved along with them, owing to their intimate relationship, which is not true regarding other deciduous teeth. The deciduous molars, therefore, are directly responsible for the positions of the bicuspids; they also directly influence the positions of the permanent first molars, and in this way influence the positions of the second and third molars, and, as explained, they are responsible in many cases for the occlusion of the anterior teeth. Therefore, we should see that the deciduous molars are placed in normal occlusion, kept there until the proper time for their loss from the arches, and removed at that time.

A STUDY OF SOME FUNCTIONAL INEFFICIENCIES OF THE TEETH ASSOCIATED WITH OCCLUSAL ANOMALIES*

By Milo Hellman, D.D.S., New York City.

GENERAL CONSIDERATIONS.

THE relationship between the teeth and the living organism is of so intimate a character that not only the odontologist but also the students of more remote sciences are beginning to emphasize its significance. When it is considered that the three most reliable sources of scientific evidence, paleontology, comparative anatomy and embryology are replete with records bearing upon the paramount importance of this relationship, it may be realized what extensive proportions the knowledge of the teeth is assuming.

Thus, in the discoveries of fossils ample evidence is obtained in the dental organs furnishing clues that point the way to a better understanding of the nature of those extinct animals whose remains are found in the more remote earth crusts, thereby giving valuable information regarding evolutional incidents.

Comparative anatomy discloses the progress made in the course of evolution in the manifestation of the advantages gained by the animals exhibiting variously specialized dental organs, adapting them to the exigencies of the different kinds and character of existing foods and equipping them with weapons for combat.

Embryology, by its epitomized history of the development of the race, bears unmistakable evidence of the effects of hereditary, physiologic and pathologic influences as reflected upon the teeth during the development of the individual.

THE HUMAN DENTURE.

The normal human masticating apparatus was thoroughly studied and aptly described by such authorities as Mühlreiter,[1] Black,[2] Angle,[3] and others. The advantages gained by, and benefits derived from, sound teeth in normal occlusion could in no instance be exaggerated. But although a vast amount of literature is devoted to the commendation of the normal dental apparatus, the profession in general either fails to grasp the weight of the arguments adduced or misunderstands or misinterprets the principles involved when their application is necessitated in conditions arising upon digressions from the normal. It is, therefore, intended in this essay to touch upon certain functional inefficiencies associated with the dental organs, emphasize their significance, point out their probable immediate origin, and, in some instances, their possible prevention.

THE FUNCTION OF MASTICATION.

The primary function of the teeth is the mastication of food. It necessarily follows that in order to have perfect function, there must be a thoroughly efficient organ to perform it. In other words, a normal adult denture, consisting of

---

*Read before the Harlem Dental Society, New York City, October, 1916.
[1]Mühlreiter, E.: Anatomie des Menschlichen Gebisses, 1891.
[2]Black, G. V.: Dental Anatomy, 1902.
[3]Angle, E. H.: Okklusions-Anomalies der Zähne, 113.

thirty-two teeth, must be so constituted that each individual tooth is enabled to do its share of work in accordance with the law of "physiologic division of labor" in the proper performance of its function when chewing food. If a tooth fails to do its full share of work in the act of mastication either through absence or pathologic inability, the functional value of that denture is decreased not only to the extent of one thirty-secondth part of the normal human adult denture as is quoted by various authors, but a great deal more. Each individual tooth has a unique function; i. e., its function differs from that of any other tooth in the mouth; this, of course, depends upon its normal form, normal size, and normal position. In proportion to its deviation from these three fundamental conditions, it will individually affect functional efficiency. Furthermore as every tooth in each jaw is opposed by two approximating teeth in the other jaw, with the exception of the lower central incisor and upper third molar (see Fig. 1), if one is functionally disabled, it will also similarly involve its antagonists. It is conse-

Fig. 1.—Normal occlusion. (After Noyes.)

quently quite plain that although one tooth constitutes a thirty-secondth part of the adult human denture as far as the number is concerned, it represents a far greater quantity when its functional value is considered.

Moreover, as the absence of a tooth breaks up the continuity in the series of elevations and depressions in the grinding plane of the denture and destroys the mutual support derived by the proximating contact, it also tends to allow displacement or migration of the adjacent teeth, and thereby further decreases functional efficiency. A fair illustration of the functional disturbance of a denture that would undoubtedly have reached its normal development if nothing had interfered with the natural course of events is represented in Fig. 2. It may be seen that owing to the loss of the lower left first permanent molar, which was extracted at an early period in the development of the denture, the adjacent teeth approximate each other, almost entirely obliterating the space of the

extracted organ. Thus, a valuable developmental stimulus has been eliminated; the result, as may have been expected, can be seen by the failure of the forward growth of the alveolar process and teeth anterior to the extracted molar, they being in distal occlusion, and a forward and inward tilting of the teeth posterior to it. The vertical as well as the horizontal position of the teeth on that side is consequently abnormal. A better idea may be obtained by a comparison of the occlusion on this side with that on the undisturbed side (Fig. 3). The protrusion of the upper teeth in the anterior part of the denture may also be observed. The extent to which the median line has been disturbed is seen by

Fig. 2.—Case showing malocclusion caused by early loss of lower first permanent molar. Space is obliterated due to lack of forward growing of teeth and alveolar process anteriorly and forward tipping of molars posteriorly.

Fig. 3.—Same case as Fig. 2, showing normal occlusion on the side where no teeth were extracted.

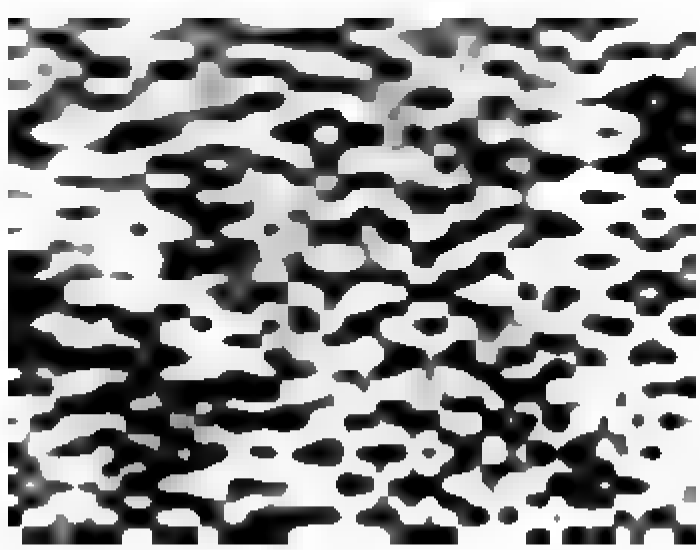


Fig. 4.—Front view of same case, showing disturbance of median line as indicated by vertical mark due to lack of forward growth of left side of the lower dental arch anteriorly to the extracted first lower molar.

the vertical mark (Fig. 4). So then, through the loss of one tooth in this instance normal development has been interfered with and the efficiency of two-thirds of the denture has been impaired. Beginning at the right canine region and proceeding toward the left and distally, all the teeth are in malocclusion. What is the moral of this case? Would it not strongly suggest that if the space left by the *presumably inevitable* extraction of the one tooth had been maintained by artificial means, this whole condition might have been prevented? It is undoubtedly much simpler, a great deal easier and more economical—at

least from the patient's viewpoint—to prevent the occurrence of such a disturbance than to create it and then necessitate the correction by orthodontic means.

That similar causes bring about like effects will be evident when the consideration of another case is resorted to. However, besides the disturbance of the teeth in their occlusal relations, interfering with the masticatory function, there were in this case also pathologic complications of the soft tissues. In Fig. 5 it will be observed that the lower left first permanent molar is missing. The conditions created on this side of the mouth are similar to those in Fig. 2.

Fig. 5.—Left side view of similar case to that in Fig. 2 showing like effects.

Fig. 6.—Right side view of case of Fig. 5, showing condition of upper first molar and its relation to the lower.

Fig. 7.—Occlusal view of the upper arch of case as Fig. 5, showing disturbance in the alignment of the teeth, condition of the right upper first molar and hypertrophy of the gum tissue in that region.

On the right side, however, of this denture (Fig. 6) it will be noticed that the upper first molar is broken down, and there are evidences of the dentist's interference. The result of this condition may be seen in the hypertrophied appearance of the gum tissues surrounding the first and second molars (Fig. 7). Owing probably to the pathological condition of the upper first molar itself, the function of mastication seems to have been preferably performed on the left side of the mouth. Meanwhile, the lack of function, coupled with the carious condition of the molar and its infected pulp increased the inflammation and hypertrophy of the soft tissue in that region to such an extent that the second upper

molar is almost entirely covered by the gum. Another instructive lesson taught by the condition of the gum tissue when the two sides of the dental arch are compared is that the functional side presents a generally clean and hygienic appearance of both the teeth and gums, while the afunctional side is found covered with deposits of mucus and detritus of foodstuffs which under normal conditions are removed by the massaging effect of the food gliding over these surfaces during the act of mastication, as well as by the normal functional activity of the epithelial layer covering the oral cavity.

Fig. 8.—Right side view of case, showing missing upper right lateral incisor mal-shaped, lower first molar gold crown preventing the second premolar from its reaching the occlusal plane.

Fig. 9.—Left side of the same case, showing missing upper left lateral incisor, second premolar in proximity to the second molar, leaving space of first molar which was extracted intervening between the two premolars.

Fig. 10.—Occlusal view of lower dental arch of the same case, showing form of right lower first molar crown and its effect upon the adjacent teeth

In this, as in the previous case, a great advantage would have been gained if the space created by the extraction of the lower left first permanent molar had been mechanically maintained; and, if the right upper first permanent molar would have been properly treated, the malocclusal condition could have been in a large measure, at least, averted and the functional disturbance prevented.

It is obvious, then, if the elimination of one tooth is liable to produce such marked occlusal disturbances, what may be the result of more extensive complications. In Figs. 8 and 9 is presented a denture, the functional value of

which is almost nil. If carefully examined it will be found that besides some developmental shortcomings, there are also certain peculiarities of growth, aggravated by inefficient dental operations. As it will be observed, this individual has had the misfortune of being deprived by nature of two dental organs. The upper lateral incisors are missing and their germs seem never to have been developed. Fig. 9 the lower left first molar was extracted when the patient was quite young, probably before the eruption of the second premolar, and the latter tooth has taken its position adjoining the second molar, leaving part of the space created by the loss of the first molar intervening between the two premolars. On the right side of the lower jaw (Fig. 8) the first permanent molar seems also to have been defective but owing to the corrective measures adopted by the dentist, the probable loss of that tooth was prevented. The manner in which this result was accomplished constitutes by no means a standard toward which the modern dentist would feel irresistibly attracted. What the end in view in that case may have been, in the dentist's mind, is certainly not clearly demonstrated by the result. Esthetically, the gold crown upon the molar would hardly be considered a model of beauty; functionally, the tooth is not only worthless, but also harmful. For, as may be seen in Figs. 8 and 10, the tooth is reduced in its anatomical dimensions, it has the form of anything but that of a lower molar, serves as a splendid medium for the displacement of its upper antagonist, and prevents the second premolar reaching the normal occlusal plane. As was said above, the primary function of a tooth is to masticate food, and in order to be able to perform this function, it must be normal in its anatomical makeup, and occupy the position allotted to it by nature. If our efforts exerted in the saving of teeth fall short in either of these demands, our endeavors have been useless and our mission has not been fulfilled.

Another important consideration in conjunction with this problem that is worthy of our attention is the phenomenon of equilibrium existing between the activity of muscular force and the physical resistance of the teeth. In the normal masticating apparatus the force exerted by the muscles of mastication must be counterbalanced by the resistance of the teeth, peridental membrane, and alveolar process during functional activity. If the muscular force remains normal and the denture, through mutilation or otherwise, is prevented from rendering its required resistance, the equilibrium is disturbed and the overburdened teeth and their investing tissues greatly weakened. This may give expression in extensive wear of the tooth structure, if it be poorly calcified or affect the peridental membrane and alveolar process, if the tooth itself is sufficiently strong to withstand the force of the muscular pressure and the wear of the triturated substance. If, on the other hand, the muscles of mastication adapt themselves to the weakened condition of the dental organs, they in turn will gradually lose their normal consistency and may eventually atrophy.

Normal development in general is dependent upon the correlated activity of many parts of the organism. If in any part stimuli and responses are lacking, the development of that part is arrested or inhibited. The stimuli may be physical, chemical or nutritional. In the examples cited it is apparent how, by the elimination of one member of the dental series, the efficiency of the entire

organ of mastication may be disturbed. However, the nature of the disturbance is in a large measure determined by the nature and state of the individual at the time of its occurrence and by the character of the disturbing factor. Thus similar causes may give rise to considerably more complicated conditions, while like results may be due to less significant causes if manifested at an earlier period of life. For instance, a carious cavity on the proximal side of a tooth—if it happens to belong to the deciduous series—may produce a decrease in the size of the entire dental arch as well as a change in its form.

The proportion which disturbances of this character may assume as a result of decayed teeth will be evident from the models of a case illustrated in Fig. 11. The child was six years old when the impressions were taken. Notice the extent of the ravages of caries in this mouth, and the effect this condition produced upon occlusion (Fig. 12). Every deciduous tooth still present is irreparably disintegrated, while six of them had to be extracted. Observe furthermore, the functional value of this masticatory apparatus. Is there any

Fig. 11.—Front view of case, showing malocclusion due to extreme disintegration of deciduous teeth.

Fig. 12.—Side view of the same case, showing effect of decay upon the efficiency of the organ of mastication.

possibility of any solid food being masticated by such a denture? And were it possible, think of the number of bacteria lodged in those carious crevices that would be mingled with the food and carried into the alimentary canal.

The carelessness of a physician who administered medicaments deleterious to tooth structure without the necessary precautionary measures, and the ignorance of the parents in not applying to the dentist for the prompt and proper care of the teeth, are entirely to blame for the dilapidated condition of this child's mouth.

Another case that may be of interest in this connection is portrayed by the model Fig. 13. It represents the denture of a child five years of age. The only decayed teeth noticeable are the lower second molars, which are almost entirely broken down (Fig. 13A). Owing to the extreme fear of this child for the dentist and probably lack of the proper psychic influence of the latter, the teeth were allowed to go by default. I am aware that it was impossible to control this child in the dental chair. It must, however, not be omitted to state that there were very little difficulties encountered in the operation of obtaining impressions, from which these models were made. What happened to this child's mouth

may be appreciated on examination of the models (Figs. 14, 14A, and 14B) prepared from impressions obtained two years later. That such a masticatory apparatus is entirely devoid of function, will be readily admitted. The conclusion

Fig. 13—Front view of deciduous dentition, showing extremely decayed lower second deciduous molars. Also a left upper supernumerary lateral incisor.

Fig. 13*A*.—Occlusal view of lower dental arch of the same case as Fig. 13, showing the condition of the decayed second deciduous molars.

Fig. 14.—Front view of the case of Fig. 13, showing effect upon occlusion two years later.

Fig. 14*A*.—Left side view of the same case, showing condition and relation of the teeth from the lateral aspect.

Fig. 14*B*.—Right side view of the same case, giving another aspect of malocclusal condition.

one must inadvertently arrive at is that in order to have a thoroughly efficient masticatory apparatus, it is imperative to have not only the full complement of teeth in normal occlusion, but also each tooth must represent morphological

perfection, anatomical completeness, and physiological potency. Or, as Angle formulates it: "The shapes of the cusps, crowns and roots, even the very structural material of the teeth and their attachments are all designed for the purpose of making occlusion the one grand object, in order that they may best serve the chief purpose for which they were intended, namely, the cutting and grinding of food." All human beings bring the qualifications and possibilities of an efficient masticatory apparatus with them, but owing to the numerous disturbances the individual is subject to it devolves upon the knowledge of the parents, the advice of the physician, and the skill of the dentist to make them realities.

THE FUNCTION OF RESPIRATION.

Respiration, though a topic that would apparently concern the rhinologist exclusively, is, nevertheless, of no little interest to the dentist and to the orthodontist. For, just as the highest efficiency in the function of mastication is at-

Fig 15.—Occlusal view of upper dental arch before treatment, showing extreme narrow palate in the premolar and first molar region and lack of room for the alignment of the canine teeth.

Fig. 15*A*.—Occlusal view after treatment of the same case as Fig. 15, showing enormous increase in width of the dental arch and palate, sufficient room having been made for the accommodation of the canine teeth.

tained through the normal activity of the teeth, so also is the perfection of the function of respiration dependent upon their normal passivity. Normal respiration, that is, natural nasal breathing, is dependent upon two general conditions:

1. A clear and healthy nasal tract.
2. Normally shaped jaw bones and dental arches in harmonious relation.

The first condition is entirely rhinological in its aspect; and as its consideration would involve a departure from the scope of this paper and lead us into other special fields of work where the best presentation by an orthodontist might prove but an amateurish attempt, it is deemed best to refer those interested to authoritative works on rhinology and proceed with the topic from the dental viewpoint.

With regard to the second condition we may divide the disturbances into the following types:

A. Those due to teratological or deformed conditions of certain parts of the jaws, such as the alveolar process of either jaw bone, or the palate process of the upper, and

B. Those due to well-shaped jaws but disharmonious in relation to each

other, such as Class II and Class III (Angle) cases of malocclusion where the dental arch formation may be quite right, but the teeth not in normal occlusion.

In the teratologic type there are cases that present a deformity in certain portions of the upper jaw, while the lower jaw may be quite well formed;

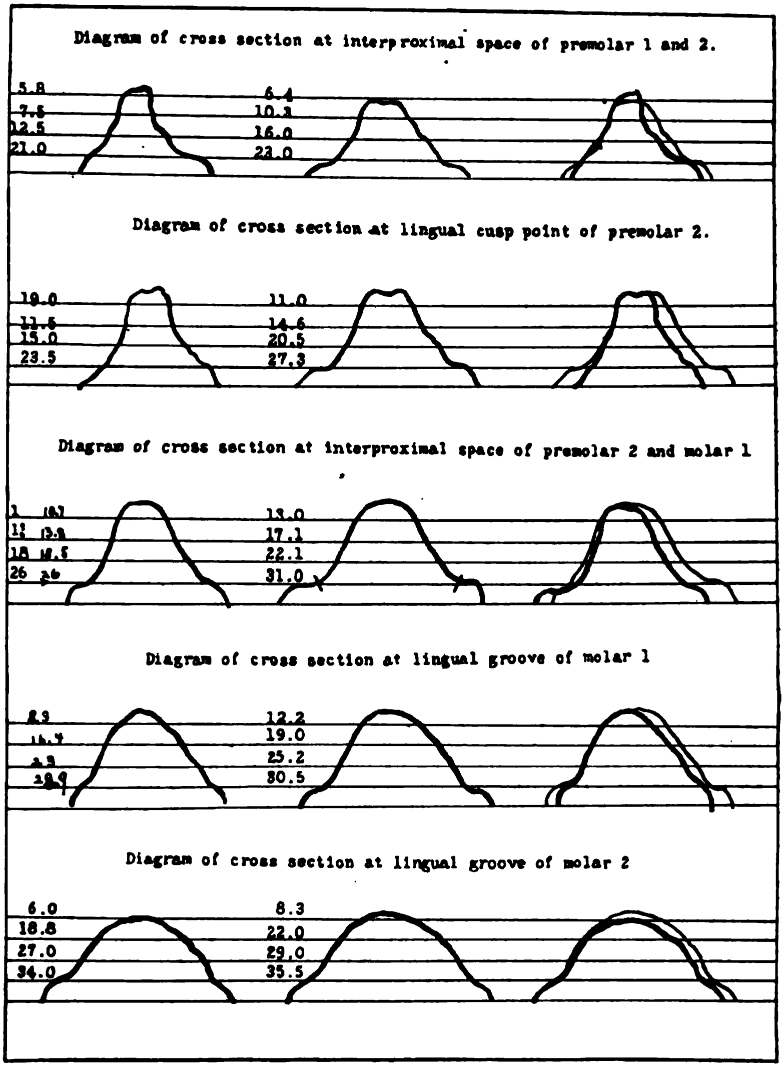


Fig. 16.—Diagrams of case of Figs. 15 and 15*A* to illustrate the change in form of the palate during orthodontic treatment. First column presents tracings of sections made from impressions of the palate before treatment; second column presents sections of impressions after treatment; and last column, the composite figures of the former two columns. The numbers give the measurements in millimeters of the various points where the lines of the diagrams are intersected by the horizontal lines. The composite figures give a graphic presentation of the change in form of the palate before and after treatment.

and others again may present just the reverse condition; i. e., the upper jaw may apparently be in good form and the lower deviate considerably. The deformities in the upper jaw are mainly limited to the hard palate. The vault of the palate is usually narrow and high; the lateral halves of the bony plates constituting it, instead of describing a gradual curve, unite in the median line

in such a manner as to form an acute angle, the so-called V-shaped vault. If it be remembered that the tissues constituting the hard palate are but thin plates of bone, forming the roof of the mouth by their under surface and the floor of the nose by their upper surface, it will be apparent in what manner the nasal chamber will be affected by such a deformity of the roof of the mouth. Fig. 15 illustrates a case of such description. Two rhinological operations were unsuccessful in the restoration of nasal breathing. The nasal tissues were so sensitive to various disturbing factors that the slightest cold, for instance, would occlude the constricted nasal chamber. As it is difficult to convey a correct idea of the form of the palate from the models, representing the occlusal surface of the same upper dental arch before and after treatment (Fig. 15A), diagrams were prepared from sections of an impression to illustrate the exact condition. Fig. 16 shows the diagrams of impressions of the palate region of this case, and in order to emphasize the degree of this malformation, similar diagrams of the same case after treatment were made and placed side by side as well as in a composite form to facilitate comparison of the previous condition and the subsequent improvement. It must not be omitted to state that with the change produced in the shape of the palate, the extreme susceptibility to "colds" also disappeared, and nasal breathing was greatly improved. Thus it is shown that in this case nasal breathing was defective not only through pathological conditions existing in the respiratory tract, but also through a deformity correctable by orthodontic measures.

In the lower jaw these deformities are not as frequent. But when they do occur, they present disturbances of an entirely different character. Thus, the alveolar process with the teeth may assume such forms as to describe any figure but that of a dental arch. The teeth may be so malposed as to encroach upon the space allotted for the tongue and the latter prevented from assuming its normal position when the mouth is closed. Fig. 17 illustrates a case in which the lower jaw (Fig. 18) was so deformed that it was impossible for the patient to rest his tongue on the floor of the mouth during repose and handicapped him in its manipulation during the articulation of speech, to which I shall refer later; the distance between the lower second premolars being 13.7 mm. while it should be 31.7 mm. as it measured after completion of treatment.

In order to emphasize some points, it will be necessary to digress for a moment and consider the oral mechanism involved in nasal respiration. "In the normal breather the mandible is raised and the teeth brought into occlusion, and as the act of swallowing is performed, the tongue expresses the air from between itself and the roof of the mouth, the lips and cheeks are sucked down upon the teeth, the lower lip binding over the lower edge of the upper incisors [and canines] the soft palate is raised and then allowed to drop upon the dorsum of the tongue, shutting off the oral cavity. The teeth then just drop apart from occlusion, and the mandible is suspended by atmospheric pressure and the muscles of the cheeks and lips are in repose" (Stanton). It is, therefore, clear that when the mouth is closed, the tongue fills the entire oral cavity between the dental arches, while the lips are in contact with the teeth externally, so to speak. The

tongue, lips and cheeks are in a relaxed condition, held in place by muscular tonicity and atmospheric pressure.

If the last two cases be recalled, it will be obvious how impossible it would be to force the tongue against the roof of the mouth in the former, and to rest it on the floor of the mouth in the latter. And where there is no provision for the repose of the soft tissues surrounding the dental arches during nasal breathing, as in the above cited cases, the mouth will not stay closed without special effort. That effort may be exerted when the individual is conscious of it, but the moment consciousness is lost, as during sleep, the tissues relax, the mouth opens, and respiration is changed from nasal to oral.

While in type *A* form of disturbance, the nasal passage is encroached upon by the deformity of the hard palate and the tongue is deprived of its room either by the encroachment of the deformed palate or malposed teeth and deformed alveolar process, in the second form, type *B* disturbance, nasal breathing is interfered with by the inability of the lips to assume their normal position mainly

Fig. 17.—Case of malocclusion in which lateral sides of the lower dental arch was so constructed as to prevent tongue from assuming its normal position.

Fig. 18.—Occlusal view of the same case as Fig. 17, showing extreme narrowness of premolar region, interfering with the resting of the tongue during respiration and its manipulation during speech.

through the effect of disharmonious relationship of the jaws and the consequent malposition of the teeth; as, in Class II and III (Angle).

In Fig. 19 it will be obvious how impossible it would be to place the lips in their normal position, as is necessary in nasal breathing when the mouth is closed. As a result of this condition the lower lip instead of resting upon the incisal third of the labial surface of the upper anterior teeth, giving an expression as shown in Fig. 20, it assumes a position between the lower and upper anterior teeth, just filling in the gap created by the malocclusion (Fig. 21). The upper front teeth are grasped between the upper and lower lip, giving not only an unfavorable expression to the face, but also aggravating the occlusal condition and interfering with respiration; for as this position can not be maintained indefinitely, due to the unnatural muscular tension in the effort exerted in bridging the gap between the upper and lower teeth, the lips drop apart when the mind is diverted from them, and mouth breathing is the result.

Again, when the malocclusion is of a reverse character, as in Class III, Fig. 22, the normal relationship of the lips is again interfered with and similar conditions, but of a reverse order, are brought about, as in the cases cited. In this instance it must be mentioned that mouth breathing, apart from nasal and nasopharyngeal disturbances, was due not to the malrelation of the jaws alone, but

Fig. 19.—Side view of case of malocclusion, showing how the abnormal position of the teeth prevents the lips from assuming their normal position during respiration and the impossibility of bringing the incisors into correct position as is necessary in the enunciation of the sounds of s, z, sh, etc.

Fig. 20.—Facial expression of case presented in Fig. 19 after successful orthodontic treatment, showing correct position of the lips during normal breathing.

Fig. 21.—Facial expression of the same case as Fig. 20 before orthodontic treatment, showing abnormal position of the lips.

also to the unusually large tongue and underdeveloped upper jaw. It may readily be seen that an enlarged tongue could hardly be adjusted against a palate of the size of Fig. 23, which will be appreciated when the subsequent size and form of the same dental arch after treatment is observed in Fig. 24.

It can thus far be safely concluded that, as the process of decay may so

impair the teeth individually as to render them incapable of proper mastication, so certain forms of malocclusion will interfere not only with efficient mastication, but also with normal respiration.

THE RELATION OF THE TEETH TO THE FUNCTION OF SPEECH.

The obvious dependence of articulate speech upon the dental organs is at once evident when a person with missing upper incisors endeavors to pronounce any words containing such sounds as are represented by the letters *f, v, s, z, j,*

Fig. 22.—Side view of a Class III (Angle) case of malocclusion, showing condition which prevents the lips from proper apposition during nasal breathing and interfering with correct enunciation in the articulation of speech.

Fig. 23.—Palatal view of the same case of Fig. 22, showing diminished dental arch, due to lack of space for the right upper canine, and consequent difficulty of apposition of tongue during nasal breathing.

Fig. 24.—Palatal view of the same case as Fig. 23 after treatment, showing change in form and size of dental arch.

sh, ch. Thus it is a well recognized fact that in the old people with edentulous mouths speech becomes indistinct owing to the defective enunciation of these sounds. Actors have long ago recognized these deficiencies, and when impersonating the aged will imitate the manner in which these sounds are uttered. For instance, the sound of the letter *f* will be produced by bringing the upper and lower lips together by the edentulous person and forcing the air out between them, while the individual possessing the necessary teeth will express that sound by placing the upper border of the lower lip against the incisal edge

of the upper incisors. Also in children it is generally known to be a natural course of events for these sounds to become defective during the period intervening from the shedding of the deciduous incisor teeth to the eruption of their permanent successors. However, between the extremes of the correct enunciation in the individual with the normal denture and the completely defective speech in the one with the edentulous mouth, there may be found a continuous gradation of defects in the production of such sounds that vary from the least recognizable to the most marked. Of course, in resourceful man, particular effort and careful exercise may correct these faults by special training. Thus we have ventriloquists who can make themselves quite well understood by the manipulation of the tongue in such a manner as to pronounce every word without the use of the lips. But while ventriloquists can speak intelligibly by the use of special artificial means, it is in a good many instances a great effort to speak correctly under ordinary circumstances when certain parts constituting the mechanism of speech become defective. So we may have a disturbance of speech known as *cluttering,* when the desire to speak exceeds the ability to do so; or *stuttering,* when owing to some nervous disturbances the tongue or lips can not be finely controlled.

But even with the nervous and muscular elements in the best of conditions the articulation of speech may be affected when the teeth are in malocclusion. For instance, in the correct articulation of all the vowels it is first of all necessary for the tongue to assume a position in the floor of the mouth and then by changing the form of its dorsum and the shape of the aperture between the lips the various sounds are pronounced; as *a, o, u, e, i.* If Fig. 18 be examined again, it will be evident how impossible it would be to accomplish this. Under ordinary conditions it would require a distance of about 30 mm. at least between the lower second premolars to accommodate a normal adult tongue on the floor of the mouth in that region, while in this case the teeth were only 13.7 mm. apart. As this patient is a young lawyer, it may be evident how handicapped he was in the discharge of his duties.

Of the consonants the sounds of *s, sh, z, f* and *v* will be mentioned. Thus for the sound of *s* the incisors of both the upper and lower jaw are brought into an edge to edge position, and the tip of the tongue is placed behind and below the lower incisor teeth. And for the sound of *sh* the same position of the incisors is maintained, while the position of the tip of the tongue is changed from the previous one to that behind and above the upper incisors, in the region of the first palatine rugæ. While for the sound of *z,* the tip of the tongue is moved slightly forward and the voice is added to the current of air. If we now examine Fig. 19, we may see how difficult it would be to assume those positions with the teeth in that form of malocclusion. Also the sound of *f* or *v* would be difficult of proper articulation, in such case, since the lower lip inadvertently comes in contact with the lingual surface of the upper incisors instead of the incisal edge. But while in this case there are only difficulties encountered in such effort, there are cases where there is no possibility at all to accomplish it. Fig. 22 represents one form where it is impossible to bring the incisors edge to edge, for the mandible can under no circumstances be retracted to accomplish

it. Figs. 25 and 26 present another case where the position of the teeth is such as to prevent absolutely the normal production of the *s*, *z*, or *sh* sounds. The best that could be done in this instance by the patient was to produce a lisping sound instead, which was accomplished by substituting the tongue for the lower incisors; i. e., placing the tip of the tongue against the cutting edges of the upper incisors. The lisping sound may be very "cute" when prevalent in children, but when it becomes settled in the form of an acquired habit, it becomes a serious handicap to the adult. It is then extremely difficult to overcome despite the correction of the occlusal disturbance and remains a menace to the permanency of the orthodontic result.

CONCLUSION.

In closing it may not be amiss to emphasize the following points:

1. That the efficiency of a denture is dependent not only upon "the full complement of teeth in normal occlusion," but also upon each tooth being complete in its form, integral in its constituent parts, and secure in its attachments to the supporting structures.

Fig. 25.—Front view of open bite case, showing impossibility of expressing correctly the sounds of s, z, etc.

Fig. 26.—Side view of the same case as Fig. 25, illustrating more clearly the inability of bringing together the incisor teeth as is necessary in the articulation of speech.

2. That with the loss of one unit of a denture the functional efficiency is reduced to a vastly greater extent than that represented by the relative numerical proportion of the teeth in that denture.

3. That the teeth, though vitally concerned in the mastication of food, constitute at the same time important adjuncts in the perfection of the functions of respiration and of speech.

4. That with every digression from the normal in occlusion affecting the process of mastication, there is also a corresponding deviation from the normal in respiration and speech.

5. That in proportion as these fundamental facts will be fully recognized and the lesson involved appreciated, we may learn to heed more the warnings in every act of our professional duties, urging us on to the best efforts, with the punishment in the shame of failure and compensation in the glory of success.

FACIAL IMPRESSIONS AND CASTS

By Oren A. Oliver, D.D.S., Covington, Va.

Part II.—The Front Facial Cast.

PART I of this article on facial casts and impressions treated of the methods of making facial impressions in general, and outlined in detail the construction of only the profile cast. The general principles of the formation of the front facial cast are also given in the preceding article, for the applying of the plaster, and the pouring and finishing of the model are very similar in the two phases of the work, front and profile. It is unnecessary to repeat the advice to the operator as to the care of the patient in the work, hence, only the operation itself will be outlined with detailed description of the work only where the construction differs from that of the profile impression.

In the making of either of these casts the patient should relax in a comfortable position in the chair, or, if convenient, should recline on a table. In the construction of the front facial cast, if the patient is placed in a chair, the head should be thrown well back, though in a comfortable position, in order that the full front facial view may be within easy reach of the operator.

Fig. 7.

Fig. 8.

The pasteboard barrier is again brought into use in making this cast as in the other, only in this case the piece of round lead wire which is pressed against the face so as to conform to the features, includes more than the profile, and is placed in such a position that it outlines that part of the face that is to be shown in the finished cast (Fig. 7). This wire should be removed very carefully to prevent any change in the form. The shaped wire is then placed on a piece of pasteboard; with a pencil a mark is made around the wire, outlining it, and then a sharp knife is used to cut along the line and remove the

inner part. The remaining frame is fitted to the face of the patient to serve as an obstruction to spreading plaster (Fig. 8). This barrier will not stay in place as easily as the pasteboard form used in the profile cast, and therefore must be fastened on securely. A small hole punched about midway on either side of the frame enables a string to be tied around the head to hold the pasteboard form closely to the face.

Of course, it is necessary to furnish some way for the patient to breathe during the operation, and for this purpose two small rubber tubes may be utilized. These tubes are soft enough to prevent injury and yet defy the plaster. Care must be exercised that the breathing apparatus is not too large or it will cause the nostrils to bulge, yet at the same time, tubes too small might make the breathing difficult. These tubes must be fastened in position, which is best when they form an obtuse angle with the nose. To hold them at this angle, a

Fig. 9.

loop of string draws them together and then ties through a hole at the top of the board (Fig. 8). The reason that the adjustment of the tubes is important is that they may be at the most beneficial angle to the comfort of the patient, and at the same time may enable the operator to work the plaster around the nostrils without interfering with the breathing device.

After the frame is in place on the head, one of the first things to be done is to cover the face with vaseline, as is described in the preceding article on the profile cast. When this is done, the tubes are thoroughly greased, placed in the nostrils and adjusted, and the face is in readiness for the plaster coating. Before this is spread on, the patient had better be given a paper and pencil that he may write a message in case of any difficulty in breathing or any other trouble. A mix of plaster is made in a large bowl, and with a spatula, is carefully spread over the features. Enough plaster must be used in this first mix to cover the entire facial surface to be included in the cast, for if a second batch must be used to piece out the first, a seam showing the joining is the result. The coating should begin at the nose, working down to the mouth and chin and

then back up to the eyes, if these are to be included in the impression. When the first mix has completely covered the face, a second is put on to strengthen the cast (Fig. 9).

When the plaster has thoroughly hardened, it may be removed by gently working the impression up and down and then crosswise in order to get it well loosened. Before raising it entirely, it should be lifted carefully at one side to see that the eyebrows or eyelashes have not become entangled with the plaster while it is still wet. If such is the case, a small thin instrument passed between the face and the plaster will readily loosen the impression.

When the impression is dry, and the coat of shellac is put on and dried also, the model should be retouched with water and plaster to remove air bubbles and remedy any other blemishes. If this is done, after the impression

Fig 10.

is dry, a second varnishing of shellac should be applied, and later, a thin covering of sandarac. The cast is now ready to be poured and the plaster can be worked well down into the tiny crevices by the use of a small camel's hair brush. If, when entirely dry, the original plaster mass is marked off for separation (Fig. 4, Part I) and block by block the sections are cut away, the almost completed cast may be removed from the mold (Fig. 10). A plaster knife used on the edges and surface will render the features clear and intact, while a final retouching with plaster and water will remove any surface scars, giving a smooth and finished appearance. Then after corks have been inserted in the back of the cast (Fig. 6, Part I) to provide a means of suspension by wires, the finished product remains.

(To be continued.)

RODGERS' TRIANGULAR CHART FOR TRIMMING DENTAL PLASTER MODELS

By Frank C. Rodgers, D.D.S., St. Louis, Mo.
Professor of Orthodontia in the St. Louis Dental College.

PLASTER models that are intended to be used for display or record should be carefully finished, since the appearance of a model is usually an index to the skill of the operator, and the time spent in doing this work carefully is not wasted.

The following rules should be observed for finishing the art portion of the model:

1. Horizontal plane: When the models are placed on a level surface the upper plane should be parallel with the lower, and not tilted in any direction.

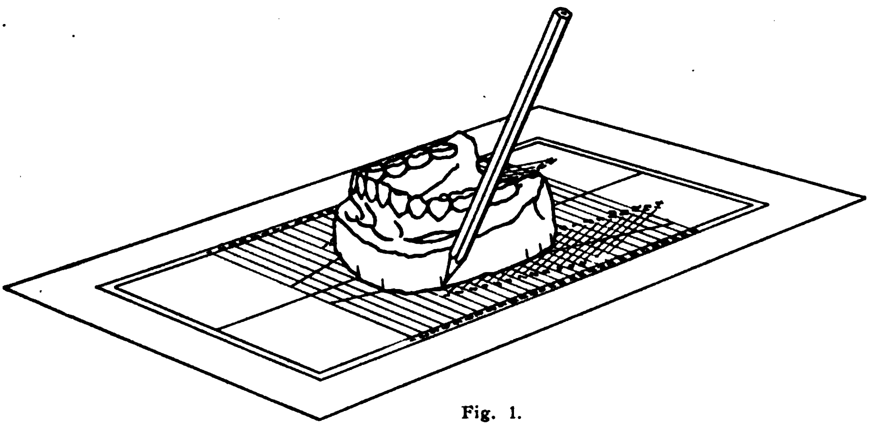


Fig. 1.

2. The walls should be perpendicular, and form right angles to the top and bottom of the model when articulated.

3. All the angles should be equally distant from the center line.

4. The upper model should be as wide as the lower. (Models finished according to the chart are standardized, and will present an artistic and mechanically perfect balance.)

In Fig. 1 a model is shown ready for marking. It should be placed on the chart so that the center line will pass through the center of the model, establishing the medium line. (Fig. 2 illustrates the chart.)

The heavy lines shown in Fig. 3 represent the outline of the finished model. The lines B are first located by placing the model on the chart, so that the triangular lines will pass just beyond the buccal surface of the teeth. This point, where the line passes in front and emerges in the rear of the model, is indicated by a pencil mark, and forms a junction with lines 5 and 18.

The anterior line A is established by locating the line which will pass slightly beyond the labial surface of the anterior teeth, as shown in illustration. This line forms a junction with line 8 on the chart, and is indicated by pencil mark.

Posterior line C is located by noting the line that passes just beyond the

distal surface of the molar. This is indicated by line 20. The posterior angles *D* are located by the line passing distal to the proper distance to the posterior tooth, indicated on the chart at 16. The anterior line on the model is drawn by placing a ruler opposite the pencil marks. The excess plaster is trimmed away in the usual manner with a plane, then finished with a file.

The anterior portion of the lower model is generally rounded off, as shown by dotted line *A*. The circle is found by placing the points of a divider at the angles *A*, then changing the points to the center line and describing the arc of a circle, as indicated by the arrow at *A* and the radius line.

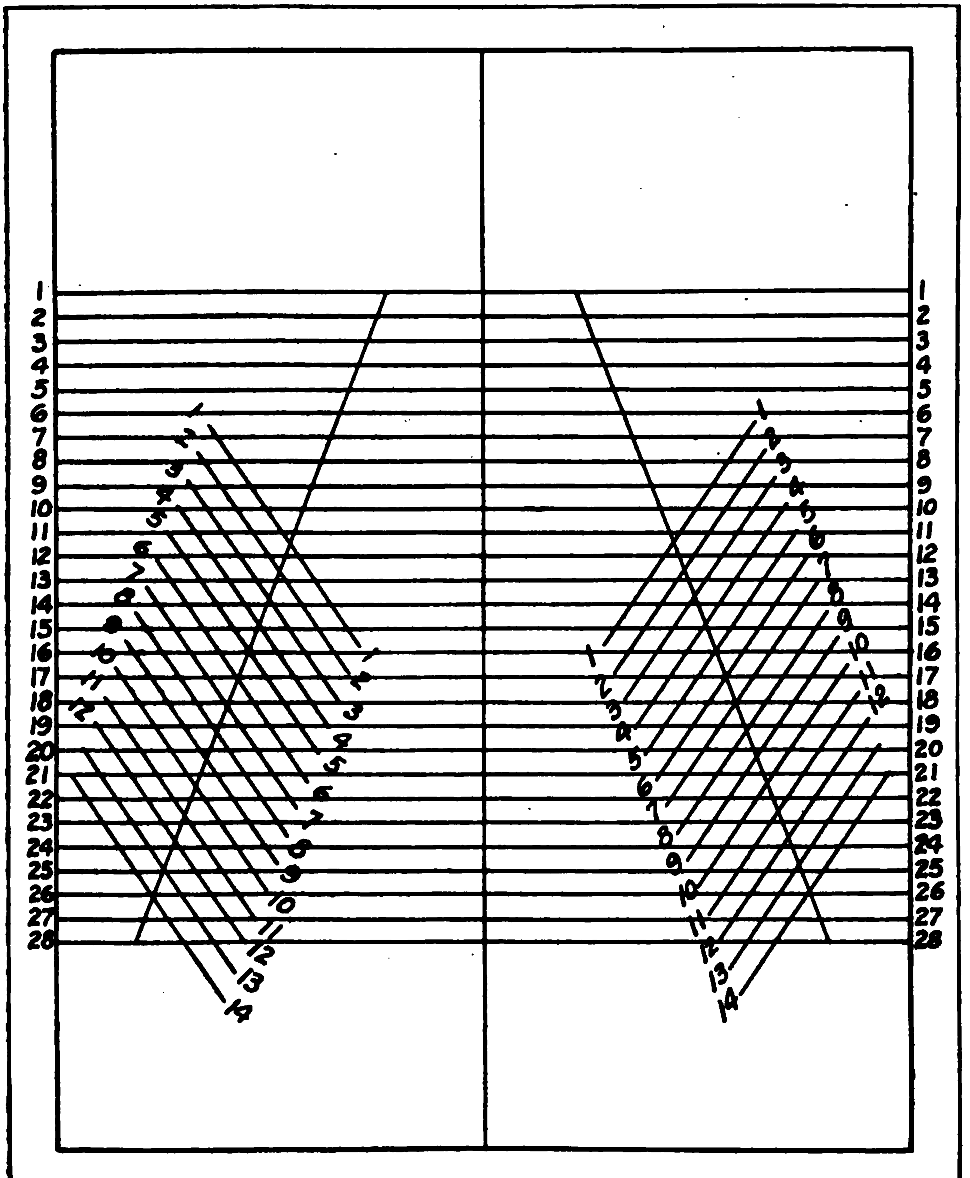


Fig. 2.

After one or two trials, the operation of trimming models will be found so simple that the average office girl will be able to do this work just as perfectly as an experienced operator, and in one-third of the time.

Figs. 4 and 5 show models that are trimmed according to the chart mentioned above.

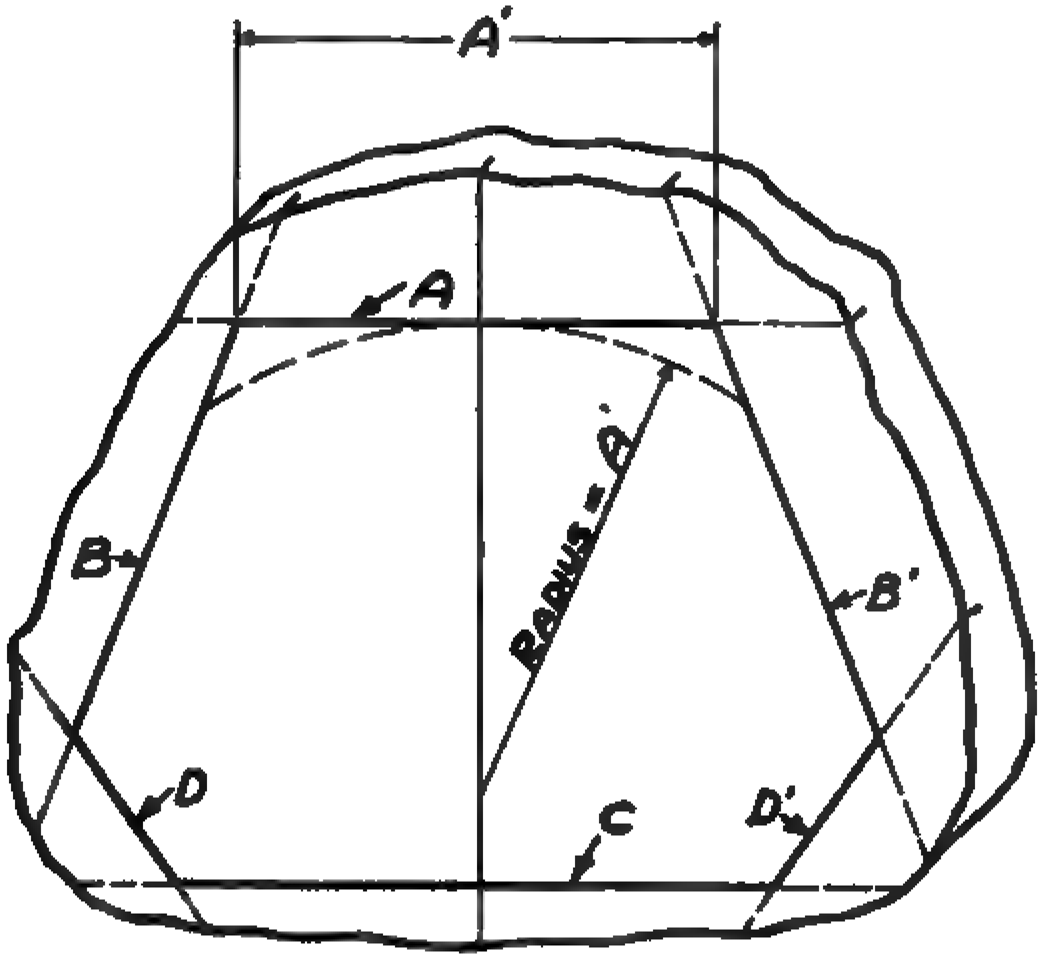


Fig. 3.

Fig. 4.

Fig. 5.

ORTHODONTIC HABIT-CULTURE AT HOME: AN IDEAL GIFT TO YOUR CHILDREN*

By George Van Ness Dearborn, M.D., Ph.D.,

Professor of Psychology and Education, Sargent Normal School, Cambridge; Psychologist and Physiologist to the Forsyth Dental Infirmary for Children, Boston; etc.

IN the now passing fashion of exchanging gifts, often is there real difficulty in the choice of fit presents; and the pampered children are sometimes hardest of all to "fit." Among the obvious criteria of fitness of an ideal gift are these: First, it must be something that is not already possessed; second, it must be continually useful and actually serviceable; third, it must be lasting; fourth, it must be a reminder of the giver, often and everywhere; fifth, it must not be an extravagance; and sixth, it must be something not otherwise to be had, in all probability. My present intimating notion of an ideal gift fulfills each of these requirements, as you will see later.

A generally and frequently useful thing is better for the most part than one of only occasional use: A watch, a fountain pen, a tape-measure, a jack-knife, a road-map or a work-basket is far better in the long run as a gift than are objects of only rare use, such as a box of Christmas candles, a package of fire-works, a ticket to the Stadium, a compass, or a birthday-cake. In other words, an object is desirable also somewhat in proportion to its general usefulness and applicability.

Were not almost every one fully supplied already, so that one seldoms feels the lack, we should realize furthermore that rules and measures are the most useful of all objects to very many of us. Foot-rules, yard-sticks, tape-measures, scales of all sorts, watches, thermometers, gill-cups in the kitchen, gas meters, coins, bank-notes, quart-measures, clocks, and barometers. But even more useful yet than these, we should find were we without them, would be *abstract rules,* principles, and guides, such as the multiplication table, the square-root rule, the metric system, the laws of business, recipes for mince pie, and for bread, the ten commandments, etiquette rules, the laws of hygiene, and the Constitution of the United States.

Ideas are the most influential things in all the world, and especially abstract rules of life, of successful, happy living, applicable always each day and hour, in every field of life, in Roxbury or in the Kameroons, today and on the last great day of all, and to every mother's son or daughter of us. Glance back over what your parents actually have given you and you will be glad to admit that the rules and measures, especially the abstract ones (because most generally applicable) have been of exceeding value to you, more so than any objects have ever been, made of steel, of glass, or gold. Neither your parents nor you may realize this, but assuredly it is true. Things are not less real, and certainly far

*Remarks made, for the most part, the Sunday afternoon before Christmas, 1915, to parents and nurses at the Forsyth Dental Infirmary for Children, Boston.

more useful, because they are abstract, and to be handled with mind rather than with muscle.

The Wisdom of Life above all other things we know is the most precious heritage that civilization and our humanity itself have given us as birthrights. Practical life-psychology especially is part of the coming ideal home-education which is so much discussed in our books and magazines of today. Indisputably mothers and fathers (as has been so often pointed out) are the natural elementary teachers of young children. How much of primary life-importance the mother teaches her little boys and girls! Only the motherless children feel, and show when they grow up, how much of life they have missed.

We often hear of "feminine intuition," and it is one more respect in which women far excel men; there are many of course. Women are fully the equals of men, but built differently in body and mind for a reason. They are not "equal" in the mathematical sense, but are fully equivalent, always. The more we learn about this master-mystery of creation, woman, the surer are we that she is entirely equivalent to man; not so good at voting and jury-work, perhaps, but equivalent in general to man, and in *intuition* she far excels. If we examine feminine intuition, we find it to consist essentially, first, of subconscious feelings and emotions; second, of subconscious reason; and third, of a more or less conscious understanding of a life-situation. Woman is more sensitive to these dim, subconscious impressions, and what is more, has learned to trust them. A mother's intuition regularly is greater than all others, for the biologic interest is greater in the mother than elsewhere. Some day, in the year 2037 or 2698 perhaps, the mothers will teach their children up to, say, nine years of age, for they will be fit then to do so.

The modern recent playground experts and physical educators will perhaps fuse their part with that of Seguin, Montessori, Witte, Sidis, and the others, and with that of Berle, Mrs. Stoner, and Wiener, into a practical coherent system of intensive out-door home-education, until the boy or girl is nine years old at least. Great possibilities certainly exist for such a fusion into such a system of elementary education. And by then the mother will know how to administer it, and find her greatest joy in doing so. Let us hasten that day.

Even now (civilization is only 10,000 or 12,000 years old, but a moment in our racial history of a million years) many women and especially mothers realize their opportunities in the educational direction. Many realize how basally educative is the home.

In my course in principles of education, we discuss ten educative influences in the home: Hereditary talent and substantiality; the recognition of authority; religion and ethical training and knowledge; knowledge and guidance in sexuality; home-reading; domestic science proper; physiological habituation; hygiene; intensive home instruction. The last three (the formation of habits, hygiene, and intensive home education) are part of our subject this afternoon. Many mothers and older sisters and fathers realize the importance of these influences and practice them by teaching them to the boys and girls. To them this special word. But how many do not! To them this general word of appeal is needful

and expedient. Even though children are unconscious of it, and very often the parents also, nevertheless the children cry out for practical wisdom.

Wisdom of how to live well—life-psychology, is what I mean. Three hundred thousand years ago when our ancestors wore only skins and lived in caves (before the Ford war-relief, the wireless, the "busy Berthas," even before men had to hang on straps going home) perhaps parents then paid relatively more attention to this element of a child's education than they do now; how to live: shoot, sew, cook, tend the baby, even "chase the growlers,"—but away from home then rather than into it. Since men learned to print and make lasting books, this phase of education has undoubtedly degenerated, proportionally to the rest.

My present notion of the ideal gift for your children, then, is for *more personal educative association with them,* especially when young and up to, say, nine or ten years of age. This (in general the most important of all things in many person's lives) can not be learned at all as yet in any one school-series anywhere; no school has such a "study." The sweetest association almost in the whole world in this: this spiritual influence over your own offspring in practical life-psychology. It is "handing on the lamp of life" in one of its most substantial aspects.

"Dreams that the heart doth hold
  Shall the later years forget?
Days of the drifted gold,
  Shall you fade and wane and set?
Let the moon grow cold, let the stars grow old,
  But stay ye a little, yet."

Psychologists are you all, though you may not know it. Psychologists enough at least to understand your own children's minds and to start them on the right road to wise living and self-control in the broadest sense; what your fathers and your mothers taught to you. Psychology is no mystic lore, no esoteric alchemy hard to comprehend; but a plain simple science much of which your child of seven or eight could readily understand if properly explained by one who really knew how.

Do not, I beg, let the term psychology, with its foreign-looking first syllable, worry you or scare you away. The Greek patriot who sells you vegetables is not dangerous just because his name is Theophilous Hadzikyriakes, nor on that account are his pears any harder to digest, or his prices harder to understand or to pay. Psychology likewise is tame when familiar. The science still maintains in spots some false pride, a little haughtiness or arrogance (because descendant of Plato and of Democritus, is it?), but in reality, modern psychology is as splendidly fitted to be one of the most essential of all grammar school studies as to be work for the philosophic doctorate in a university. You, as applied psychologists, should be, I repeat, the instructors of your children in the psychology of life wisdom. To be so is a privilege as well as an obligation, and assuredly an obligation as well as a delight.

Now, at length, is our cat indeed out of our Christmas bag, or down off the tree, so to say. This is the bait with which I have caught your kind, idea-seeking attendance here this afternoon; this is "the ideal gift to your children"—

worth to them, think I, anything else you could give them, if not more: Some practical psychology, some wisdom of how to live well. More intimate guidance in those concerns with behavior in which they are wholly dependent on you, is what I mean.

This is a birthright, not a privilege, and it is one of the children's many inalienable rights, only one or two of which so far man has recognized and then allowed. A father had a life-and-death right once, and even a son, and much less a daughter, had scarcely a right merely to live. Today we have passed beyond that grossly brutal stage, and now other rights less material and all the more important press for recognition. Conspicuous among these children's rights is that of inheriting by nature the wisdom of the parents and of their parents. Experts in the re-education of delinquent children recognize and emphasize these home-influences. The well known Dr. Wm. Healy, of Chicago, in his recent work on dishonesty, says: "School information is superficial compared to the realities of social behavior and charity that are taught first under the parental roof. Going over our juvenile court material of one thousand young repeated offenders, averaging fifteen and one-half years of age, we find that in no less than fifty per cent of the cases the natural parental relationships were incomplete. Moreover, added to this, there were many other instances in which there had been just as little parental supervision as if the parents were dead or living apart. . . . Both the negative and positive phases of a child's mental life and conduct are imperiled without parental care." In no one of its aspects certainly is it more essential than in this matter of bad-habit prevention.

But talking until New Year one could scarcely exhaust the possible directions which this applied psychology might take, this wisdom of how to properly live, unwritten, and unattainable otherwise by the average child.

Today, I am thinking of one part of this maze only, but that is an important part; namely, *our usual utter slavish servitude to habit.* The great psychologist, William James, worked out the practical aspects of habit. One sees there and all about him that even the children, and young children, already are "slaves of habit," "creatures of habit," bound firmly with often invisible chains to a behavior-series which they themselves are choosing day by day, minute by minute, though they know it not.

Good or evil, habit is surely our master. Because in this vast kindergarten of our lives, habit and habit's useful restraint are but the two basal aspects of "the great chain wherewith we are bound" to be sure, but also the very guerdon of our slavery. Here is the respect in which our "wills are not free;" here this ancient endless discussion of the "freedom of the will" gets its only sanction—in the psychology of habit. But it is every child's to make it free.

In a dental institution you not unnaturally expect to hear about the mouth or the throat or the nose, let us say about the inside of the face. Some of you, however, will be less interested in what I am about to say were the effects of this special servitude to habit wholly confined to the "inside of the face," not affecting at all the outside and its important beauty.

Knowledge and understanding, then, (to be finally explicit) of *the psychology*

of habit (especially as it concerns the face) is my own suggestion of the ideal gift to your children, during this winter, say, and next summer and on and on.

Recall, if you please, our noted criteria of an ideal gift, and then observe that this is "not already possessed," probably; certainly, "continually useful;" lasting life-long; a "constant reminder of you," its givers; not very expensive, in fact a fine investment and not an expense at all; and, lastly, that it is "not otherwise to be had" in all human probability by your children, until too late, at least, to be of use to them. In general the most valuable things cost least; air, water, sunshine, heat, light, happiness, wisdom, life itself.

The science of habit, explanation of why habits form, may be stated very briefly for our present purpose as follows: The infant from birth (save when asleep) is so built (his nerves and muscles) that universal bodily movement is maintained. Movement-hunger, the "impulse to activity" keeps up this universal movement because the sensations arising thus are pleasant in themselves. Now, more or less by chance some of these movements prove especially gratifying and satisfying and therefore tend to be repeated over and over, and so to form habits. The sources of the satisfaction which underlies the formation of habits are nearly as various as the habits themselves. To name them would be to describe, almost, the motives of a young child's behavior, for almost universal is habituation.

Very few, even of biologists and psychologists, realize as yet how almost literally universal habit is in our movements (technically, altogether, called our behavior). But this is a fact and the fact has much importance. Only in an extremely few cases are our acts not in part already made easier by this process of habituation, namely, in truly voluntary acts.

Nature's object well attained, of course, is *economy;* economy of time, of energy, and of variation. Motions are done quicker, more easily, and more uniformly when they have been repeated until some degree of habituation has been secured. Practically our whole life is a habit-forming free will; from birth and before the process is going on. During the first months after birth the child's education gets under way in the form of physiologic habits of eating, sleeping, etc., out of which as a base the more personal habits may gradually develop. This is Nature's thrift, her practice of economy.

But a principle so basal and universal in action would be certain to work some harm as well as much good. So, in the absence of supervision, some movements and acts are made habitual that are contrary to the inherent and natural rights of the child. He becomes, *pro tanto,* the victim of the vast rolling wheel of life, made slave by the "great chain wherewith," as Walter Pater says, "we are bound."

Among the many natural inborn rights of children scarcely recognized as yet in any effective way, are the rights to be first, as *healthy* and, second, as *beautiful* as nature and nurture allow. These rights are as "inalienable" (as our national Constitution says it) as the right to be *happy.* Indeed the three are inseparable part and parcel of one portion of life, namely Youth and Childhood, "holiday," when already we have crossed one of life's borders and are still free from care. Health, beauty, and happiness, these three, are inherent parts of normal childhood. A girl-body's beauty, as Maurice Hewlett says about "Sanchia's," "is but

a poem written by God about her soul." But underlying this is the one only means by which any girl and any boy may arrive at length at personality, namely, the body itself, the material agent logically necessary in a material world. What parent, what nurse, what guardian would not give the children universally these,—health, beauty, and happiness? One of the surest and shortest methods is through psychological guidance.

The human face is the index of our personality, of our humanity itself. It is the most beautiful of all created things known to man. To preserve its normal beauty is a duty, a birthright due to every child. The outside of the human face is the at once most beautiful and interesting of all material objects whatsoever of which we know. The inside (that complex of organs and structure behind the "mirror of the soul") has more concern with health than has any other one portion of the body, and given health and beauty, happiness is not far away. This matter is really more important than the necessary brevity of its statement might suggest to you.

It is to habits of the inside and outside of the face, then, that your psychological interest in your children is to be especially directed: first, to prevent the formation of bad habits, and second, to bend them (when they are formed) down and out. No longer do we "break" habits or try to do so, lest in the fracture the delicate nerve-system, all around them, be broken too. But we bend habits freely and finally displace them out of the child's mind and so out of his behavior.

Let us note, now, some of the classes of bad facial habits which it is the duty of the Post-Graduate School of this Infirmary to discuss. I may be excused, probably, if I quote from a recent lecture on the psychology of habit:

"More or less arbitrarily we may consider four groups of kinesthetic habits especially, which lead to deformities of the mouth and of the dentition. In the first class we have the group which we may characterize as sucking movements, which involve the sucking of the thumb and fingers, fist, either lip, the tongue, or the clothing. Some of the worst cases of paradontic deformity come from the rather common habit of biting the clothing; boys especially get in the habit when young of biting the clothes and tugging on them. Perhaps more practically important than this, because commoner, is the use of the so-called "pacifiers," which really should be called something else, even defacifiers. A second group of actions is the biting-habit; biting either lip, the tongue, or the hands. Biting is a well-defined instinctive movement in most young mammals. Third, a group which requires less effort than the other two, namely, mouth-breathing, one of the commonest, I take it, of the causes of malocclusion. It appears to be always forced by a respiratory obstruction. The passage of air through the nose is normally, at least, as easy as it is through the mouth, so that no one with entirely unobstructed posterior nares breathes through the mouth. The fourth class of paradontic habits includes a very large number of arbitrary actions, including those of the busy hands in relation to the mouth, all sorts of tractions, distentions, etc., habits of many kinds that young children and sometimes older children get into, of handling their mouths in many various ways. I do not need to cite the numerous other causes of malocclusion, but there are at

least thirty-five conditions which have been mentioned by witnesses as causes of this kind of deformity, diseases, maldevelopments, pure habits, too complex to even mention here, today. As important as any one thing is the use of "pacifiers," of many kinds, something that may be sucked, the sucking being, like virtue, its own and only reward. "Pacifiers" indeed! Men use them, you say? Men may use them (cigars), but not babies; it is a man's right, but in his case the defacement is relatively small.

To prevent the very existence of these unhealthful and disfiguring habits and such as these, is a psychological privilege, it seems to me, of every person who has any care of any child, from birth to puberty. It is also an obligation, and one not to be escaped without the bruising of one's conscience.

Every child has a right to be as beautiful as nature allows, indeed it is a duty to be so. But "cosmetic values, of course, are very greatly disturbed by some of the muscular habits that children get into. If we compare the women with the children who sit before us in the trolley-cars, for example, in this respect, we can see the effects ahead as well as the causes behind. You can readily point out certain children who, when they become adults, will have badly deformed, and perhaps unworthy, faces simply because they have been allowed to form the habit of holding their mouths, and so on, in various postures which are going to become fixed. How many good men are needlessly scared away from matrimony by this contrast between the middle-aged women whom they sometimes see and these women's children. Physical education should care for these conditions," but, out of inertia, it has not yet taken up systematically this task, much as it has done elsewhere for the betterment of the world.

The standard from which to judge whether a bad habit be developing or not is one of pure common sense. It needs only this, and no technical professional wisdom.

The practical method of preventing the formation of these habits of, on, and within the face, with the complicity often of the hands, is as simple yet as scientific as well it might be: *A self-interested understanding of the conditions involved, both immediate and future, an appreciation of the process, in short, and of its effects. Impression of the subconscious mind and hopeful encouragement, with the necessity of continual initiative of restraint.* In the way of prevention, nothing can be done from without but this, nothing at least that is at all justifiable as a preventive method. On the other hand, perfect success by this method oftentimes is assured, at least in proportion to the intelligence and the promise of the individual child. One can not do more than this. Indeed, here in a way is almost a measure of the mortal's effective self-respect and of his proper educability. One can not do more. But in the long run it is safe to say that no child is going to allow her face to be disfigured, or her nutrition to be jeopardized, if she really understands fully her power to prevent such catastrophies. Why not let her and her brother understand it as fully as you can? And if no such habits impend, then the like philosophy of other bad habits which are fairly sure to be forming? As in psychotherapeutics, "mind-cure," there must be full comprehension and stimulating encouragement. These means will do much, very much more than you probably believe until you actually try them, to prevent bad

habits of many kinds. You must secure in the child a continuous, if subconscious, attention to the task. The self-protective mechanism of the mind tends to accomplish the rest.

The sad familiar lines of Wordsworth sing in one's ears:

> "Full soon thy soul shall have her earthly freight,
> And custom lie upon thee with a weight
> Heavy as frost and deep almost as life."

But once formed, you ask, how may these disfiguring and often dangerous deformities of the face,—so far functional and habitual, and not "grown in"—be cured? The means and methods have been hinted at already, but it may be made more explicit in seven points:

1. Not, at any rate, by literally "breaking" the habit. In adults, unless they be unstable, habits may be and often mercifully are, broken off short, although with raw and bleeding ends and edges of agony—the morphine habit notably. Habits can not be broken in this way in children, at least not after the age of two or three months. The problem here is a very difficult one, as difficult as childhood is from age.

2. The method then of bending bad habits down and out of a childs' behavior is that again of psychological therapeutics, "mind cure." *A self-interested comprehension of the hard conditions involved, immediate and remote; with a vigorous impression and encouragement of the subconscious mind with the absolute necessity of continuous restraint.*

It is in this idea of the *incessancy* of the requisite personal control of the impulse to habituated action that the difficulty chiefly lies. James has emphasized in his discussion of habit what we all feel to be the very heart of the matter: "Each lapse is like the letting fall of a ball of string which one is carefully winding up; a single slip undoes more than a great many turns will wind up again." Hence the need of employing sentinels and guards that never sleep and which are to be absolutely relied upon; for the impulse to activity knows no such thing as inattention, but every moment watches for an opportunity in proportion to its habituation.

No other guard whatever serves or can serve this supreme watchfulness save the (subconscious) mind itself, loyal protector always, without a lapse, of the best interests of the individual so far as they are impressed upon it by the freer intelligence and through the stringent orders of the emotional, dynamic phase of the child.

It is like inducing an individual to be good or to be kind or to be gentle, or an active youngster to be quiet. It requires continual effort from within. This, however, is an education in itself. This indeed is pretty much of the whole matter: a true and full understanding of the habit-trap and its injuries, and of the ease and certainty of escape provided the child consciously and subconsciously really and sincerely wishes to be relieved of it. It all depends on continuous voluntary initiative founded in enthusiastic confidence and determination.

3. Encouragement and confidence are essential, for the average child has as yet little self-reliance. It is part of his very childhood not to have it, and the wholly self-reliant child is already a man or a woman.

4. Another essential feature of the educative habit-bending methods is that one habit only at a time, for the most part, may be attacked. The reason for this is the wise old adage of our grandmothers:

> "One thing at a time and that done well
> Is as good a rule as any can tell."

In the physiologic terms of psychology, this is the principle of the "final common path," or, in this case, of cortical resultants.

5. The depression and the discouragement of fear and worry are wholly out of place in this inherent bending of a child's subtle and sensitive mind. Fear and worry block the will and hinder it, and lower its vigor as they do its spontaneity. Fear is wholly incompatible with the best results in such influence as this, and that wholly aside from the danger of imparting a lasting shock to the brain of a child.

This necessity of avoiding fear and worry in the child, eliminates serious threats of future punishment. It rules out, too, all harshness and severity. This is not that kind of a problem at all, You do not threaten a boy or abuse him for a too long convalescence from tubercular hip disease; neither should you in this case.

Punishment is in fact outside this whole matter unless, be it first, of a mild sort; second, highly successful; and, third, free from all terror. Corporal punishment would be an absurd factor in a process of subtle reform from within outward such as we are discussing. You must impress the mind rather than the soft part of the back, and so in principle all through. The whole Freudian doctrine of repression and rankling and nervous exhaustion comes into this problem when early shock or fear has been incurred. The far-reaching evils thus made possible would be worse indeed than the original bad habit; in this case, undoubtedly, the remedy is infinitely worse than the disease.

6. Busy normality of the nerves and muscles and glands is an important adjunct, and often a necessary preliminary, to habit-bending when the habits are of serious import to the child.

Back to the farm, even in winter. Months of freedom and plain outdoor living among the beautiful hills and rapid streams and the maple groves of Vermont or along the satiating Acadian seashore,—herein lies invigoration. In practice sometimes only in this manner is the mechanism of nerves, muscles, and glands given its normal vigor to recognize habit abnormality; to refuse its allurements; and by its inherent powers of self-protection to bend it out of existence again.

In many cases of deranged moto-sensory habit an active and conscious normalizing thus procured, in intelligent children, is enough almost in itself for a cure.

7. In other instances it must be admitted, the skilled orthodontist or even the surgeon finds his wits well taxed to make things right. But the way of ways is prevention rather than cure, a system for guiding the daily inclination of the "twig" rather than the difficult and tedious and even dangerous back-bending of the "tree." We call prevention of this kind by a familiar special name, prophy-

laxis, but more properly, here, it is psycho-prophylaxis. Prophylaxis is scarcely born as yet in either medicine or dentistry. When, however, (before many decades) it has become part of the common mind of all the people, how crude, how extravagantly wasteful, will seem the neglect of the present day! Nothing less than shameful to our boasted human intelligence is the colossal wastefulness of happiness and life and money in this respect. What is it then which many of us are so much in a hurry to obtain that we cannot stop to live? We should prevent disease, altogether, and deformity.

It is fortunate, indeed, for us all that this bending of a habit itself becomes habitual and so ever easier and easier. "To him that hath shall be given." "God helps those who help themselves." Thus the habit of bending any particular habit soon becomes habitual, as do the habits of close study, of taking sufficient exercise, of cold morning baths, of giving your loving wife her inevitable last word, or of any other habit hard, often "beastly" hard, at first to compass. So the child by trying at last succeeds, and more easily, often, than at first seemed possible. And by trying, whatever his years, he becomes a personality—a man—captain of his soul.

Nothing is finer, let us be sure, or few things, at least, in this wondrous life of ours than this slow, hourly mastering of ourselves, a bit by bit, day after day. Then at length we begin to appreciate the privilege of being conceived and born into even a brutal world, an experience often harsh and worrisome and sad, often cruel, even, to a wholly unbelieveable extent, but always, notwithstanding, full of an almost inexplicable joy arising to a large extent in our own dominance of ourselves.

This joyousness of satisfaction has its most familiar symbol in the crushing of inexpedient habits,—links in that great living chain with which life forever binds itself, but through which alone human personality is conceivable.

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

JAMES DAVID McCOY, D.D.S., EDITOR
LOS ANGELES, CALIF.

THE RELATION OF RADIOGRAPHY TO ORTHODONTIA*

BY WILLIAM A. GIFFEN, D.D.S., DETROIT, MICH.

THE roentgen ray as a diagnostic aid in the practice of orthodontia is indispensable. It is a fact that there is no other branch of dentistry in which the findings of this agent are so definite.

I shall first enumerate the conditions in which the roentgen ray will eliminate all guess work for the orthodontist in making a diagnosis of his case:

If the roots of the deciduous teeth are interfering with the eruption of the permanent teeth.

If the permanent teeth are present.

If they are in a normal position.

If the supporting osseous tissue is of normal density.

If there is delayed eruption—what is the interference.

If permanent teeth have been injured by instruments in removing roots of deciduous teeth.

If in delayed eruption the cause is want of space in a certain direction, can sufficient space be obtained?

The progress of eruption of teeth which have been delayed.

If devitalized first molars or other teeth are present, are the surrounding areas free from infection or evidence of toxic irritation.

If there are any supernumerary teeth present.

If there are cysts or odontomas or other anatomical deformities present.

If pyorrhea pockets exist.

The orthodontist, as well as the general dental practitioner, must take advantage of this valuable aid in the future in order to protect his professional reputation.

It is the writer's opinion that the chief reason so many dentists do not take advantage of the roentgen ray is their desire to save their patient the expense of such an examination. This is a foolhardy policy upon which to conduct a dental practice, for even if an occasional patient does object to the expense or for any reason does not see the importance of such an examination, it is the plain duty of the dentist to at least explain to his patient the possible advantage of the examination; for as a matter of fact owing to the publicity which has been given to the bacterial origin of most human ills through the

*Read before the Alumni Society of the Dewey School of Orthodontia, Chicago, Ill., March 13, 14, 15 and 16, 1917.

current magazines, the laity are not so ignorant of health questions as many seem to think they are. A dentist should not be afraid to lose patients with so little intelligence they can not realize the value of good health and appreciate honest effort of their dentist to protect it.

AVAILABILITY.

There is no reason why any one of you can not learn to make radiographs if you feel inclined to go to the necessary expense to equip yourselves and can give the time necessary to work out the details of the technic. The essential requirements are an efficient apparatus, industry, common sense, and a knowledge of the danger of too lengthy or too often repeated exposures to the rays. However, this is the simplest part of the work as it requires a great deal of study and practice to become proficient in the interpretation of the radiographs after they have been made, no matter how good they may be.

It is a fact that fifteen operators have sacrificed their lives in this country alone, and many operators and patients have been maimed and disfigured from the same cause. So should any of you decide to take up this work, never fail to fully protect yourself and your patient.

SYSTEMATIC TECHNIC NECESSARY.

As in all other dental operations a definite procedure should be followed in making the examination. A clinical record should first be made by marking on a chart of the mouth all lesions which can be seen or discovered by a digital survey, such as fistulous openings through the mucous membrane, swollen or tender areas, ulcers, enlarged areas either hard or soft over the labial and buccal or lingual surfaces of any of the roots of the teeth; all missing deciduous or permanent teeth crossed out; also check off any teeth suspected of being nonvital. Fillings should also be marked on the chart. With this chart record to refer to the operator will be enabled to sum up the findings of his roentgenograms and arrange them properly on his mountings, accurate and in the minimum of time.

The position I prefer for the patient is in the dental chair tilted back, and for centrals and laterals place the film parallel to the long axis of the medial line and direct the rays on the film as nearly at mean angle between long axis of tooth and film as is possible. For cuspid and molar region place film parallel to long axis of first molar and direct rays on film as near the mean angle as possible, the patient holding the film in position with the thumb. For right side of face use left thumb and for left side of face use right thumb, either upper or lower. In the lower cuspid and molar region place the film parallel to the long axis of the first molar and direct the rays as near to right angles of film as is possible.

As a rule children rather enjoy the examination when they understand that it will not be painful, although it is hard to get them to hold the film for lower bicuspid region occasionally when the soft issues of the floor of the mouth must be depressed. In difficult situations of this kind place the patient on a table with the head on a soft pillow, using a 5x7 film on the outside of the mandible.

Fig. 1.

Fig. 2.

Fig. 3

Fig. 4.

Fig. 5.

Fig. 6.

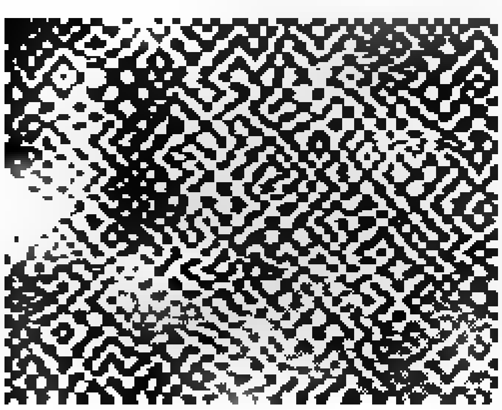
Fig. 7.

Fig. 8.—An unusual case of missing lower centrals.

Fig. 9.—Bicuspids not present. Lack of bone development.

Fig. 10.—Delayed eruption caused by retention of deciduous molar root.

Fig. 11.—A remarkable case. One bicuspid tooth absent, the crown of the other bicuspid being malposed, the cuspid having erupted distal to it. Development of bicuspid has been arrested and also shows a great lack of osseous development mesial to first molar.



Figs. 12 and 13.—Delayed eruption. Lack of space.

Fig. 14.—Showing encysted central. Girl 16 years of age.

Figs. 15 and 16.—Showing serious results produced by unerupted teeth.

Fig. 17.—A supernumerary lateral apparently perfectly developed.

Fig. 18.—Two permanent cuspid and lateral teeth fused together.

Fig. 19.—Deciduous lateral and cuspid fused together. Permanent lateral missing.

Fig. 20.—Shows evidence of toxic irritation at apex of mesial root of lower first molar.

The best detail from a photographic standpoint on the negative is obtained in young patients by using Hydrogen Tube on transformer with a spark gap resistance of four inches, while passing thirty-five milliamperes at a target distance of eighteen inches through an aluminum filter and two and one-half inch compression diaphragm. Three second exposure for incisors and lower molar regions and four seconds for upper molar region.

INTERPRETATION OF RADIOGRAPHS.

Figs. 1, 2, 3, 4, 5, and 6 represent a roentgen ray examination of a normal mouth of a normal little girl at the age of five (the daughter of a Detroit dentist).

The deciduous teeth are normal, except for gold fillings in upper molars. The permanent teeth are all present and in a normal position. The supporting osseous tissue appears to be of normal density.

Fig. 7 shows upper incisors of a girl of eleven years with the following history taken from her record as filed by the Detroit Board of Education.

Minnie: Eleven years old. Mental age 6 years, 8 months. Height 4 feet, 9 inches.

Mother: Lizzie, 37 years. Weighs 102 pounds. Married at 16. Three living children—1 dead. Six miscarriages before Minnie was born. Minnie is tenth pregnancy. Had right ovary and tube removed following Minnie's birth. Positive Wassermann, Aug., 1915. Mercurial and salvarsan treatments. Attributes condition to infection from husband.

Father: Died at age of 42 years, Dec. 28, 1916, of paralytic stroke. Was intoxicated at time of stroke. Sick one week. Was chronic alcoholic.

Minnie: Full term normal birth. Born in hospital. Mother ill 3 months before birth and 3 months following. Bottle-fed. Has had measles, mumps and whooping cough. Eye trouble was first noticed March, 1916. Taken to Children's Free Hospital, July, 1916; there until August. Wassermann, negative.

Diagnosis.—Interstitial keratitis. Congenital syphilis. Weight 62 pounds. Head circumference 19½ inches. Black hair, brown eyes. Poor appetite. Personal hygiene fair. Eyes in such poor condition that she must either stay out of school or be in class of partial sighted children. Attended kindergarten and B first grade irregularly. Home conditions unsanitary; ordered by Board of Health to move.

The International Journal of Orthodontia

PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 801-807 Metropolitan Bldg., St. Louis, Mo.

Foreign Depots—*Great Britain*—Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

Subscription Rates—Single Copies, 30 cents. To anywhere in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $3.00 per year in advance. Under foreign postage, $3.40. English price: 15/ per annum, 1/6 per number. Volume begins with January and ends with December of each year.

Remittances—Remittances for subscriptions should be made by check, draft, postoffice or express money order, or registered letter, payable to the publishers, The C. V. Mosby Company.

Contributions—The editor will be pleased to consider the publication of original communications of merit on orthodontic and allied subjects, which must be contributed solely to this journal.

Opinions—Neither the editor nor the publisher hold themselves responsible for the opinions of contributors, nor are they responsible for other than editorial statements.

Reprints—Since it is not desirable to hold type standing longer than absolutely necessary, all requests for reprints should be made at time of submitting manuscript for publication. Rate card will be sent with galley proof.

Communications—Contributed articles, illustrations, letters, books for review, and all other matter pertaining to the editorial department should be addressed to the Editor, Doctor Martin Dewey, 25 East Washington Street, Chicago, Ill. All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 801-807 Metropolitan Building, St. Louis, Mo.

Illustrations—Such halftones and zinc etchings as in the judgment of the editor are necessary to illustrate articles will be furnished when photographs or drawings are supplied by the authors of said articles.

Advertisements—Objectionable advertisements will not be accepted for publication in this journal. Forms close first of month preceding date of issue. Advertising rates and sizes on application.

Change of Address—The publishers should be advised of change of subscriber's address about fifteen days before date of issue, with both new and old addresses given.

Nonreceipt of Copies—Complaints for nonreceipt of copies or requests for extra numbers must be received on or before the fifteenth of the month of publication; otherwise the supply is apt to be exhausted.

Entered at the Post Office at St. Louis, Mo., as Second-Class Matter

EDITORIALS

The Responsibility of Dental Editors

AT the present time there is considerable advocation among the various dental editors in an attempt to make the advertising section of the dental journal coincide with the belief of the editorial department. In times past we have been confronted with the proposition of a dental journal being edited by a man who had a high standing in the dental profession, who stood for certain ethical principles and who would be compelled to admit or see those same principles violated in the unscrupulous advertising which appeared in the advertising pages of the dental journal. We need go back only a short distance to recall that a similar condition formerly existed in the pages of a great many daily newspapers and it was with considerable difficulty that newspapers succeeded in making their advertising column coincide with the wishes of the editorial department. In other words, it was only in those papers in which the editorial department was large enough to control the advertising pages that we first saw

questionable advertising eliminated. We can even remember when we were confronted with the incompatible proposition of the religious weekly and Sunday School papers which in their reading columns told about the evil of intoxicating liquors, the great demon rum, the horrible sins of intemperance and various other crimes of a similar nature and then by turning to the advertising page find such advertising as "stomach bitters," Peruna, and even Duffy's malt whiskey. We are glad to notice that most of the religious weeklies have gleaned out their advertising columns until now the advertising matter is no more apt to send a man down the crooked path so far as intoxicants are concerned than are some of the articles in their editorial department. We are also pleased to notice that the majority of large powerful daily papers have also gleaned out their questionable advertising matter until now things are in a much better shape than they were formerly.

Medical journals have for a number of years carefully gleaned out their advertising, eliminated those advertisements of a questionable character and those which made statements which they could not in any way substantiate. At the present time a number of dental journals are attempting to do the same thing, but we regret to say that there are still some powerful dental journals in which the editorial department absolutely refuses to be held in any way responsible for what appears in the advertising pages. We are aware of the fact that even the *Journal of the National Dental Association* in times past contained advertisements which were more or less questionable, but we believe it is the policy of the journal to eliminate such advertising as soon as attention is called to it. However, as we have stated before there are a number of large dental journals with a large circulation in which the editorial department attempts to entirely divorce itself from the advertising pages, claiming that it is in no way responsible nor does it even care what appears in its pages. We remember recently an editor of a large dental journal making a statement that he never read the advertising that appeared in his own journal because he did not care what was in there as he was concerned only with the editorial policy. While that may be one way of ridding oneself of the responsibility, nevertheless, it appears quite embarrassing for a man to advocate one thing editorially, for one thing to be advocated in articles in his journal, and just exactly the opposite to be advocated in the advertising pages of his journal. We do not believe an editorial writer or editor of a dental journal should excuse himself by saying he does not read his advertisements and is therefore in no way responsible.

The same editor also made the statement that it was a very difficult thing for dental journals to control their advertising matter, for if a journal refused to publish the advertisements of one concern, the concern could get out an injunction claiming the journal was not fit to circulate through the mails, and thereby cause a great deal of trouble to the journal before the same would be allowed to be circulated through the United States mails. This argument is about the same as if someone were to say that we should not criticize anything regardless of what it is because someone would be liable to bring a damage suit against us and we would be compelled to defend ourselves in a damage suit.

We realize through the laxity of the United States Court that it is possible for anyone to file suit against anyone else, for anything whatsoever, thereby causing the party to be inconvenienced in defending the suit. Nevertheless, we believe that the advertising pages of a respectable dental journal should be controlled by the editorial department. While it is almost an impossibility for an editor of a dental or medical journal to read all the advertising matter which is to appear in his journal before it is published, nevertheless, it is not impossible for the publisher of the journal to have a contract so arranged with their advertising customers that an objectionable copy of an advertisement can be eliminated if the advertising copy is objectionable to the subscribers or the editorial department. Such a contract would eliminate the possibility of a damage suit by copy being refused and allow the editorial department the possibility of reviewing and changing such advertising as is objectionable to their readers.

We realize that a certain number of dental journals are run solely for the advertising department and advertisers, and the scientific section becomes secondary. This is proved by the fact that a large number of dental articles and scientific articles are nothing more than commercialized articles for we remember a short time back a famous so-called scientific article appearing in the first pages of the reading matter of a dental journal while in large type appearing on the first page of the advertising section was a large poster advertisement calling attention to the article which appeared in the scientific section. In other words, the article in the scientific section was describing a commodity which was sold by the house that published the dental journal and which article was the same as was featured in the advertising section. Therefore we can only expect such dental journals to make their scientific and editorial sections secondary to the advertising sections, which impresses upon us the prime need for dental journals to serve the scientific wishes of their editors and readers and not to serve the advertising managers of supply houses. We also realize it is a very difficult proposition to satisfy all of our readers as regards scientific articles and advertising.

Recently at the meeting of a society of national reputation, the society discussed the proposition of requesting certain dental journals to be more careful in regard to their advertising matter. After they had criticized the advertising pages of certain trade journals they suggested that certain independent dental journals be more careful in regard to their advertisements and then the society further embarrassed themselves by voting that the proceedings of that society be published in a trade journal whose editor claims that the editorial department has nothing to do with the advertising department. In other words, they became instrumental in assisting and furthering the very thing in a dental journal which they were trying to criticize or trying to regulate. This simply shows the inconsistency of attempting to satisfy everyone, for a great many people are inclined to look at things in a different light and especially from a different viewpoint when it effects them personally. However, it is our belief that dental journals which are attempting to advance dentistry as a science, independent journals which are anxious to build up independent departments, and journals

that publish the proceedings of orthodontic societies should assume some responsibility in regard to the advertising department.

We recently remember seeing a dental journal which was the official organ of an orthodontic society publish an advertisement of an orthodontic appliance, which advertisement was an insult to the intelligence of every practicing orthodontist who was a member of the society for which the journal published the proceedings. The advertisement made certain statements in regard to the use of that appliance, claimed the appliance accomplished certain things within a certain definite time, which ninety per cent, if not one hundred per cent of the members of that society knew was absolutely impractical. Therefore, we consider in that case the editorial department of the journal was lax, allowing advertising to appear in the journal which was an insult to a large number of its readers. However the whole question is whether a dental journal should be run for the interest of dental science or for the interests of the trade houses which publish a large number of them.

We admit that advertisements are a necessary adjunct to the publication of any kind of a journal. However, with the independent scientific journals, the policy is to publish a journal which, because of its high standing, will have among its readers the most desirable men in the science. Because of the readers which it has, it becomes a valuable medium for the advertising of articles and things which the readers of the journal are forced to buy, and in that and that alone lies the relation and the duty of an independent scientific journal to the advertisers. The advertisers have no right to make statements in the space which they pay for that is an insult to the readers of the journal, and not in keeping with the editorial policies of the journal. A journal should be run as a scientific publication first and an advertising medium second, which is directly the opposite of the policy pursued by some. Everything which appears in a journal should be responsible to one department and that department should be controlled by the editor-in-chief.

The Commercialization of Scientific Societies

AS we write this editorial we have upon our desk the programs of the state dental associations of a large number of states. In looking over these programs we are impressed with the fact that all of them make a feature of advertising dental supply houses and calling attention to the dental exhibits which are to be held at the state meetings. As a result of this we are forced to pause and wonder if dental meetings are for the advancement of dentistry as a profession and a science, or for the advancement of dental supply houses, or if the average state meeting as it is conducted is something to further the interests of dentistry as a science or something to further the interest of the dental manufacturer. In other words, are these meetings scientific gatherings, or are they commercial gatherings for the purpose of showing the latest things in office equipment?

We are aware of the fact that there are two sides to this question. In some

instances the dental supply men are compelled to pay the expenses of the state dental association. In a great many instances the privilege of getting out the program of a state association and the publication of the same is allotted to some dental supply house and in return, they are given a prominent place of advertising on the back page of the program. We are also aware of the fact that in times past many of the state dental associations have obtained the only available floor space which can be used for dental exhibits and have sold this floor space to dental supply men for a price much greater than what they paid for it. As a result of this, the dental exhibitors have been obliged to pay the expense of the state meeting for the privilege of making an exhibit at or in close proximity to the place of the scientific meetings. As a result of this procedure dental dealers are entitled to a certain amount of consideration, but, nevertheless, the fact that they are entitled to this consideration does not justify the means which have been employed in some instances in obtaining it. In other words, we are opposed to a state dental association, which is supposed to be a scientific organization, selling itself to dental supply men. If dental dealers are desirous of having exhibits at the time the state meetings are held, we are perfectly willing that they should make these exhibits; but we do not believe that the exhibit should be made as an adjunct to the state meeting or be in any way concerned or associated with the state meeting. When this proposition has been advocated it is then stated that the dental associations desire to have some control over the exhibitors or the exhibitors would continue to show their wares during the time the scientific sessions were being held and therefore interfere with the attendance at the scientific session. If this is true we regret it exceedingly, for if men attend a dental association to visit the dental exhibit, we are in favor of allowing them to attend the dental exhibits if they are more interested in them than in the papers to be read at the scientific session. If the members of the state associations believe they can get more good out of dental exhibits than they can out of the scientific sessions, we are willing to allow them to follow the dictates of their own conscience for it will only be a few years until the man who bases his dental progress on what he learns in the dental exhibit will be a back number. We are not willing to admit that men attend the state meetings to see the dental exhibits, but we are inclined to believe that the dental exhibitors follow state meetings for the purpose of reaching the largest audience they are able to find gathered together in one place. That this is true can easily be proved by the large number of subterfuges which dental manufacturers have taken at the present time to use state organizations as a means of advertising their products.

In looking over the programs of the state societies which we have on our desk we find that two-thirds of them have somewhere in the program, mixed in among the scientific papers, a notice of a moving picture film which is supposed to show the manufacture of dental instruments. This exhibit is worded very beautifully and is placed in the different programs following papers on root canal technic, papers on oral prophylaxis and oral surgery, papers on radiography, papers on the treatment of pulpless teeth and their sequella, and the preparation of canals for filling and various other subjects. It would seem at

first sight, an interesting topic for dental societies, a good thing to know how dental instruments are manufactured. Along with the exhibit which shows the manufacture of dental instruments is the concealed invitation to purchase this instrument and in some cases there is also shown its use and application in the treatment of oral conditions. We are not opposed to advertising, realizing that advertising is a necessary adjunct; we realize that advertising must be carried on in order to push the sale of an article but we believe there are proper mediums for advertising certain things and the state dental societies' scientific sessions are not among those proper mediums. We consider it an insult to the dental profession or the state dental meeting for large manufacturing concerns to work in between the scientific papers moving picture films, the sole object of which is the advertising of their own products. The trade houses and dental supply houses have for a number of years attempted to control the dental meetings, the publication of dental journals or attempted to control the thought of the dental profession in regard to publication, and have now gone farther by attempting to influence state societies by producing moving picture films, which are nothing more than advertisements, in scientific sessions. The surprising thing is that state societies have allowed this thing to go as far as they have, have allowed the dignity of the profession to be so insulted by permitting these things to be published in their programs.

We realize the management of organizations, of scientific societies, and scientific bodies must constantly be on the alert to prevent very carefully arranged commercialized schemes creeping into their programs.

For a number of years, or, in fact, since, the foundation of the American Society of Orthodontists, the Board of Censors have used every effort to keep out papers which had a commercialized tendency, and while they have not been entirely successful, they have been more successful than the majority of other organizations. However, we are sorry to learn that the American Society of Orthodontists seem to have taken a step backward by the fact that they are now planning, at the next meeting, to have an exhibit of orthodontic appliances. In other words, they are inviting certain manufacturers, who have articles for use in the practice of orthodontia, to have an exhibit at their next meeting. While we understand that these exhibits will be no part of the program of the American Society of Orthodontists, that each exhibitor will be forced to buy his own space from the hotel management at so much per foot or at a certain rate which the hotels are willing to make, and that the society itself will have no connection with the exhibits; nevertheless the fact that they are inviting these men to exhibit at their next meeting is in our mind a decided step backward for a scientific organization. Again we say if dental exhibitors desire to exhibit, we have no objection to them making the exhibit, neither have we any way of stopping it and we do not think it is objectionable providing they do not attempt to make the state dental associations a means of furthering their own interests. We also know that some state dental associations and dental societies attempt to charge exorbitant prices for floor space to the dental exhibitors in an attempt to make the dental exhibitors pay the expense of the meeting. We believe that scientific societies should be so conducted as to pay their own ex-

penses and the membership be sufficiently large and the membership sufficiently interested in the advancement of the society that they are willing to pay the expense and not expect dental supply men or dental dealers to pay it. We therefore hope the time is not far distant when scientific organizations will be divorced from commercial organizations and each one will occupy the proper relation to the other and its affairs.

Orthodontic Appreciation

IN a short talk given by Oscar Busby upon the subject of "Orthodontic Appreciation" he made a few remarks which were worthy of more than passing consideration. He opened up a field of thought which requires more attention from the average orthodontist than it probably has received. The question of orthodontic appreciation has more bearing upon the practice of orthodontia than probably any other factor which we have to contend with. In other words, if our efforts are not appreciated by the public, it is very difficult for us to render a service, or to continue the practice of orthodontia. In fact, it has been proved that the necessary adjunct in the practice of any profession is to have the public appreciate the efforts of the men engaged in that particular profession.

The question of appreciation has been the primary factor in the success or failure of any science or art that has ever appeared before the public. Different methods have been adopted by business houses to force the appreciation of their efforts or the article which they have for sale upon the public. It has been stated that any man, who was able to design something which the public appreciated, something which the public desired, and which everybody appreciated enough to purchase, would be on the road to independent wealth. If orthodontia is to succeed as a profession, if the public must appreciate the value of orthodontia sufficiently to enable one to make his livelihood in the practice of that profession, it then follows that orthodontic services must be made attractive enough for the public to desire those services.

As a result of a number of years' experience, we find the appreciation of the public for orthodontic services is based upon a great many different propositions. One of the first things which causes the public to seek the services of the orthodontist is in a great many instances the correction of facial deformities. This was especially true in the past when orthodontic patients sought the orthodontists after the age of twelve years. After the age of twelve the majority of individuals who seek the services of orthodontists do so for the improvement of facial appearance. Therefore, in that case the orthodontic appreciation is based upon facial improvement that can be accomplished by orthodontic treatment. There is no question that the correction of a large number of malocclusions will improve the facial deformity or profile of the patient, but we do not believe that orthodontic appreciation based upon the improvement of facial deformities is the most desirable kind of appreciation. The reason for this may be stated that a large number of malocclusions that are the most serious handicaps to the individual from a physical standpoint

and from a masticating standpoint are those cases which produce very little facial deformity. In other words, the proper appreciation of orthodontic services should be based upon the knowledge that the orthodontist is able to render a service of a greater value to the individual than simply the correcting of a facial deformity. We have seen a number of malocclusions which were so extreme that mastication of the food was practically impossible, but the patient or parent objected to having the case corrected owing to the fact that the facial deformity was not noticeable and that the greater amount of energy would be expended on the posterior teeth and the patient was unable to see where the improvement would be sufficient to compensate the necessary financial outlay.

However, we are glad to note that conditions regarding the appreciation of orthodontic treatment are becoming better; that a greater number of people are seeking the services of orthodontists for the correction of malocclusions for their children at an earlier age than they formerly did; and that they are beginning to realize that the importance of orthodontic service lies in the correction of malocclusion, thereby improving the masticating apparatus and also improving the nasal organs, producing better breathing than would be possible if the malocclusion persisted.

In order to get a higher degree of appreciation for orthodontic services, it becomes necessary that the people be educated to realize that the benefit of orthodontic treatment lies not so much in the improved facial expression, but improvement in the occlusion of the teeth which makes better usage of the teeth possible, and therein lies a greater degree of health and comfort.

The Value of the Orthodontist in Military Service

IT is only since the beginning of the European War that military men have recognized the importance of the dentist in actual warfare. For some time the government has had certain regulations pertaining to dental conditions for enlisting men in the army and navy. It has been necessary for the men to pass the proper physical examination and to have the oral cavity examined. It has been found that a great many men have to have dental work done and the mouth placed in a healthy condition before they can be admitted to service. As a result of this, the Preparedness League of American Dentists was organized about a year ago with the idea of pledging the dentists of the United States for the purpose of preparing the teeth of otherwise physically able men so that they could enlist in the army and perform military service. The purpose of the League, as first organized, was that each dentist should at least fix one recruit's mouth so that he would be able to pass a medical examination. As the work of the League progressed, it was found desirable to organize dental units which would consist of the following: an oral surgeon, orthodontist, dental radiographer, prosthodontist, dental hygienist, and dental therapeutist. It may be said that the work of the dental therapeutist and hygienist and the prosthodontist are to a certain extent preparatory.

The work of the dental radiographer may be considered 50 per cent preparatory, and the other 50 per cent fits him for actual service in taking care

of the wounds of the injured. The work of the orthodontist in military life is necessarily that of repair. The orthodontist works hand in hand with the oral surgeon and consequently the greater amount of his work will be done during actual warfare. It is a well known fact that the work of the orthodontist in fitting bands upon teeth and his knowledge of occlusion makes him especially fitted for the treatment of fractures of the mandible and maxilla, and for the fitting of appliances to hold the parts and prevent displacement as a result of loss of the mandible and maxilla from gunshot and shell wounds.

There is probably no one or no branch of the medical profession in which men are better fitted to treat a large number of fractures and treat them successfully with the smallest amount of inconvenience to the patient and with the least loss of time than is the orthodontist. As a result of this, the orthodontist in the Preparedness League of American Dentists is very necessary, and will be even more necessary in times of actual warfare than in times of military preparation. According to the small number of orthodontists in the United States compared with men engaged in other branches of dentistry, in case of actual warfare if all the orthodontists were on the front, there would not be a sufficient number to adequately take care of the need. Considering this fact, it is very evident that the orthodontist has his particular line of work to do towards preparedness, and that line of work is to give instructions to the dental profession, under the auspices of the Preparedness League of American Dentists, as to the most feasible, easiest and quickest means of applying bands and ligatures in such a manner as to reduce fractures and prevent displacement of the parts resulting from gunshot and shell wounds. It is, therefore, hoped that every orthodontist will do his part in this preparedness movement, will join some preparedness league unit and give a series of lectures on the adjustment and fitting of bands, and adjustment of wire ligatures for the treatment of fractures. By giving the proper line of instruction to the units of the Preparedness League of American Dentists, the orthodontist will do something for the service of his country the value of which will be hard to estimate.

Scientific Versus Unscientific Orthodontia

THE visual observation of the most capable living orthodontist, the usual forms of measurements of models and the comparison of models with forms of arch supposed to be common to great numbers of cases, are of little value as guides to procedure in the practice of orthodontia. Indeed they are quite as likely to mislead as to lead correctly. Upper and lower models from one mouth were submitted to a large number of capable orthodontists for diagnosis by the methods common to their practice. All recognized that the arches are too narrow to afford room for all the teeth in good alignment and that the relations of the lower teeth on the right side to their opponents are mesiodistally incorrect. All prescribed the same treatment, the application of appliances to widen both halves of both arches until the anteriors were accommodated in the tooth rows and the correction of the mesio-distal mal-relation was secured. None could give the exact forms the finished arches would exhibit and

none had any guide by which to tell when the work was finished except seeing the anteriors fall into line. An engineering survey of this case shows that both halves of the upper arch need spreading, but that only one half of the lower needs to be spread; that is, the teeth on the right side of the lower arch are already far enough from the median line, but those in the left side need to be moved farther from the median line. The first lower deciduous molar on the right side needs to be moved nearly straight forward into correct mesio-distal relations with the uppers; spreading this side would be fatal to the establishment of normal occlusion in this mouth. Models and figures show that the methods of diagnosis were unscientific and misleading. A case is shown which a prominent orthodontist had "regulated" for several years. The work was supposed to be finished with the exception of a few finishing touches to be applied to an upper central which would not align itself correctly. For two years he had pushed at this central in the effort to align it, but without success. An engineering survey of the case showed that the trouble in aligning the central did not arise in the central, but in the fact that the only forms of the arches which would affect normal occlusion had not even been suspected, and the upper arch was 6 mm. too narrow at the bicuspids. The central was being pushed out of alignment by forces not perceptible to the orthodontist and he might have pushed it as long as he and the patient lived without the slightest hope of success. A map of the uppers shows by contrast with the positions in which they should be placed. (You will note lack of expansion in bicuspid region and rotation of cuspids and molars. A map of the lowers contrasts with the positions in which they should have been placed. There is pronounced rotation of the left cuspid.—Dr. F. L. Stanton, *Dental Digest.*

Permanent Staff Appointments for the Forsyth Dental Infirmary for Children

A COMPETITIVE examination of graduates in dentistry (of less than three years standing) for appointments to positions on the Permanent Staff for full, and one-half time service will be held early in June at the Infirmary.

Appointments will be made for one or two years as follows:

Full time service requires operating five and one-half days a week at a salary of $1,000 a year.

One-half time service requires operating six half-days a week, either forenoon or afternoon, at a salary of $400 a year.

These appointments will be made subject to satisfying the requirements of the Massachusetts State Board of Registration in Dentistry and to "qualifying" in the practical work of the clinics during one month's trial.

Members of this staff will be entitled to the advantages of reports and clinics by experts in the various branches of Dentistry from different parts of the world in addition to the numerous regular clinics and lectures.

Operators after serving three months are eligible, by qualifying, for appointments in the special clinics where Post Graduate work is given.

The operators on this staff have the advantage of the clinics and lectures of the Post Graduate School of Orthodontia.

The Infirmary clinics provide unusual advantages in the various departments of the institution where Operative Dentistry, Orthodontia, Nose and Throat and Oral Surgery, Extracting, Novocaine Technic, Radiography, Pathological Diagnosis and Research Work are continually carried on.

The average number of cases treated daily is more than 450 in all departments.

All material and necessary operating instruments will be furnished; up-to-date apparatus including electric engines, sterile instrument trays, fountain cuspidors, compressed air, and the modern operating room type of lavatories are available for use.

A diploma of service will be issued by the Trustees to each member of this staff who has completed this term of service in a satisfactory manner.

Applications for the above positions should be made not later than May 15th. Information and the date of the examination will be furnished to those interested by Harold DeW. Cross, D.M.D., Director, 140 The Fenway, Boston, Mass.

The Eighth Annual Meeting of the Eastern Association of Graduates of the Angle School of Orthodontia

THE Eighth Annual Meeting of the Eastern Association of Graduates of the Angle School of Orthodontia was held at the Vanderbilt Hotel in New York City on May 7th and 8th, 1917. The following very interesting program was presented:

MONDAY, MAY 7th.

9:30 A.M.—The President's Address, Dr. Henry C. Ferris, New York, N. Y.
10:30 A.M.—Essay: Some Engineering Principles of Possible Interest to Orthodontists, Mr. G. D. Fish, C.E., New York, N. Y.
11:30 A.M.—Essay: Dr. Milo Hellman, New York, N. Y.
2:30 P.M.—Essay: Orthodontic Treatment of Advanced Cases, and Patients Coming from a Distance, followed by a Clinic, Dr. J. A. Cameron Hoggan, Richmond, Va.
4:00 P.M.—Business meeting and election of officers.
6:30 P.M.—Dinner at the Hotel Vanderbilt—Ladies invited.
8:30 P.M.—Illustrated paper: An Experimental and Clinical Study of the Isolated Thyroid Hormones, Dr. N. A. Janney, New York, N. Y.

TUESDAY, MAY 8th.

9:30 A.M.—Movement of Teeth: Predetermined by Engineering Instruments. Appliances: Designed in Accordance with Analytical Mechanics, followed by a Clinic, Dr. F. L. Stanton, New York, N. Y.
10:30 A.M.—Essay and Demonstration: Phonation, Dr. Floyd S. Muckey, New York, N. Y.
11:30 A.M.—Essay: The Evolution of the Human Face, Prof. William King Gregory, Assistant Professor of Vertebrate Paleontology at Columbia University.
2:30 P.M.—Clinics and Report of Cases:
Dr. Lowe Young, A Skeleton Bite-plane for Overcoming Deep Overbite.
Dr. A. L. Johnson, Gnathodynanometer.
Clinics were also presented by Dr. F. L. Stanton, New York City; Dr. B. W. Weinberger, New York City; Dr. J. A. Hoggan, Richmond, Va.

The Annual Meeting of the National Dental Association in New York City

THE National Dental Association will meet in New York City, October 22, 23, 24, 25 and 26. The headquarters will be at the Hotel Astor, situated on Broadway at 44th and 45th streets. This hotel has the largest ballroom in the world, and this room will be used for all the general assembly meetings. Other large ballrooms will accommodate the Sections, House of Delegates, etc. The exhibits will be shown in the beautiful roof gardens. Thus practically all of the meetings will occur under the roof of this spacious hotel.

Full accounts of the plans of what promises to be the largest and greatest meeting in the history of the association will be published later. Suffice it for the present to state that the slogan for this year will be "Quality rather than Quantity." Nevertheless, there will be quantity also. But the important announcement at this time must be the warning, *reserve your rooms at once.* Make reservations by mail direct to the hotel of your choice. This may seem premature considering the abundance and variety of hotel accommodations there, but New York hotels are always crowded. Nearly seven hundred conventions met there during 1916. October is one of the busiest months. If you desire to get into any particular hotel, therefore, it will be safest to write at once. For example, 150 rooms have been reserved at the general and registration headquarters, Hotel Astor, already. This famous hotel is situated in Times Square and contains 1,000 rooms, the rates of which are as follows:

Single with bath	$ 4.00	$ 5.00	$ 6.00
Double with bath	5.00	6.00	7.00
Two connecting rooms with bath (3 persons)	9.00	10.00	11.00
Two connecting rooms with bath (4 persons)	10.00	11.00	12.00

Rates at other hotels vary from $1.50 without bath to $4.00 with bath.

A copy of the list of hotels and rates in pamphlet form will be sent to any member of the National Dental Association who will write to the Chairman of the Publicity Committee, R. Ottolengui, 80 West 40th St., New York City, and enclose a self-addressed stamped envelope.

Dr. D. C. Bacon, Chairman of the Committee on Transportation, has issued an announcement of the railroad rates to the Convention as follows:

The Trunk Lines, New England and Central Passenger Associations have granted a rate of two cents per mile in each direction, going and returning via the same route only, limited to midnight of October 30.

Going tickets in Trunk Line territory will be on sale October 19, 20, 21, at the one way fares, on the certificate plan, these certificates to be endorsed by General Secretary, Otto U. King, and to be validated by the Special Agent of the railroads who will be in attendance on October 24, 25, 26. Return tickets to be sold on presentation of validated certificates October 24 to 29 at the difference between the fares paid on the going trip and the fares for the round trip. Return limited to continuous passage to destination and not later than October 30. This applies on tickets with a minimum of $1.00 for round trip.

New England Passenger Association tickets to be sold or certificates issued

and good going October 19, 20 and 21 and returning not later than October 30, two cents per mile each direction, shore line mileage, going and returning via the same route only.

Central Passenger Association territory round trip tickets requiring validation at New York City will be sold on October 19, 20 and 21 with a final return on October 30, two cents per mile in each direction.

There will be no fee for validation.

Seventeenth Annual Meeting of the American Society of Orthodontists

THE Seventeenth Annual Meeting of the American Society of Orthodontists will be held at Excelsior Springs, Mo., September 5, 6, 7, and 8, 1917. The meeting will be held at the Elms Hotel which is one of the finest hotels in the world. Excelsior Springs, as a resort, is famous the world over, and is accessible by three main railroad lines—the Wabash, the Rock Island, and the Chicago, Milwaukee and St. Paul.

The Board of Censors has arranged the program after the following plan:

I. President's Address, Dr. M. N. Federspiel, Milwaukee; Report of Board of Censors.

II. Anatomy, Physiology, and Etiology.—(1) The Evolution of Dentition, Prof. Osborn, New York City; (2) Further Studies in Prenatal Factors in the Production of Malocclusion, Dr. B. W. Weinberger, New York City.

III. Surgery.—(1) The Surgical Treatment of Extreme Malformations Involving the Jaws, Tongue, etc., Dr. Gordon New, Mayo Clinic, Rochester.

IV. Medicine and Pediatrics.—(1) Diseases of Infancy which Affect Development, Dr. G. Lippmann, St. Louis; (2) Food for Growing Children, essayists selected.

V. Radiography and Photography.—(1) Practical Radiography for the Orthodontist, Dr. E. H. Skinner, Roentgenologist, Kansas City, Mo.; (2) Orthophotography and Multiview Projections, Rudolph L. Hanau, Brooklyn.

VI. Pathology, Prognosis, and Therapeutics.—(1) Oral Efficiency of Therapeutic preparations, Dr. Hermann Prinz, Philadelphia.

VII. Practice and Technology.—(1) Essayist has been selected; (2) Probable essayists, Drs. Lourie, Ellis, Mershon, Cameron, Barr, Wheller, Suggett.

VIII. Legislation, Education, and Nomenclature.—(1) Essayist under consideration; (2) Report of Committee on Education; (3) Report of Committee on Nomenclature.

IX. Clinics.

X. Exhibits.—Books, periodicals, x-ray equipment and supplies, orthodontic appliances, etc.

The International Journal of Orthodontia

Editor: Martin Dewey, D.D.S., M.D.

VOL. III | ST. LOUIS, JUNE, 1917 | NO. 6

ORIGINAL ARTICLES

MUTILATED CASES OF MALOCCLUSION*

BY ADELBERT FERNALD, D.M.D., BOSTON.

Instructor in Orthodontia in the Dental School of Harvard University.

IT would be very nice if one could select those cases for treatment which have all the teeth present, the patient the proper age, and where normal occlusion could be established.

I am not going to tell about or show you normal occlusion, but will leave that for those who may choose ideal cases, in which perfect results may be secured; although I have under treatment many cases where all teeth are present, and it will be my fault if I do not get perfect results.

I wish to show a few of those unfortunate cases where mouths have been mutilated by loss of teeth and improper fillings and normal occlusion can not be obtained. I know that many will say if one or more teeth are lost, restore the remaining teeth to normal and supply the missing teeth; in some cases I would do that too, but I wish to speak about those cases where the patient has little time and less money, whose age is unfavorable, and many who are sick from inability to masticate their food. What shall we do? Tell them that they are too old, or that it will be very expensive, discourage and send them away to grow more hideous and unhappy? I will admit a man can not do charity work all the time, but there are many such cases where the occlusion can be made more efficient and the appearance of the mouth improved.

In treating any case of malocclusion, it makes a great difference if the condition is acquired, or congenital. Consider a case of Class III (mesioclusion) with one or both superior laterals missing. After treatment, it may be necessary to supply them. But in many mutilated cases I have found that by extracting one or more teeth to equalize the sets, the occlusion could be made more efficient and the patient would not be compelled to wear an artificial tooth through life, or be under treatment long.

*Read before the Harvard Odontological Society, Nov. 16, 1916.

There have been many cases at the Harvard Dental School where the four broken-down first molars have been extracted, and the second molars brought forward so that the wisdom teeth could erupt in place of the second molars. I will not say perfect, but good results have been obtained.

Fig. 1.—Case I.

Fig. 2.—Case I.

Fig. 3.—Case I.

One should use great care in deciding which tooth or teeth to extract in treating such cases, and I will show you some cases where I think someone made a great mistake in taking out any teeth at all, also cases where I have taken out premolars or canines and I will let you be judge and jury of the results.

As we get new bone growth at all ages and the tissue and cells of the body are being renewed all the time, there are few mutilated cases that could not be helped. I will show you one case, patient thirty-three years old, Class III, that I treated when I first graduated and have watched for twenty years.

I would like to report one case, which to me is unusual. A little girl three and a half years old was brought in to have her teeth regulated, a case of Class II, complete distal occlusion, a mouth breather and extremely nervous, with adenoids and enlarged tonsils. I requested the parents to have the adenoids and tonsils removed, which was done, and then to wait until the child was a little older and stronger, before having the teeth straightened. I told the little patient to keep her mouth closed at night so that spiders would not crawl in. She would retire with mouth closed tight and her hand over her lips. After the operation she became much stronger, and on seeing her a little over a year later, I was amazed to find that the lower jaw had come forward into normal occlusion, and it has remained so.

CASE I.

Fig. 1 represents the case of mesioclusion (Class III) that I referred to as being treated over twenty years ago. The patient was a man thirty-three years old. The inferior right second premolar, and first, second, and third molars had been extracted,—also the superior right canine and six year molar.

This being one of the first cases I corrected after graduating, I shellacked the models with several coats of yellow shellac, which is the cause of the peculiar appearance of the photo.

The inferior six anterior teeth had been pushed forward by the force of the occlusion, and I think in this case, the whole mandible to some extent. After the superior right cuspid had been extracted, the superior centrals had been forced back, the cuspid space was entirely closed. The superior median line was nearly one-fourth of an inch too far to the right (Fig. 3, left) the arch being very narrow. The bands were adjusted on the superior twelve year molars, the centrals and laterals carried forward, restoring the canine space.

The teeth moved very slowly, requiring so much force to move them at all, that I resorted to the jack-screw, adjusting it to the bands attached to the premolars with arms running back to the molars. The patient was given a wrench, and in eight months the premolars and molars were expanded nearly a quarter of an inch (Fig. 2). The canine space was restored by bridge-work, and a retainer consisting of a gold wire attached to bands fastened to right and left first biscupids,—also right and left first molars.

After restoring the canine space by the bridge, the patient, as well as myself, was delighted to find that the median line between the two centrals came in the center of the face, which greatly improved the personal appearance of the face and mouth (Fig. 3, right).

The inferior third molar and right and left premolars were banded to reinforce the anchorage while drawing the anterior teeth distally, which I did by stretching elastic bands from hooks on one premolar round to the other,—the patient adjusting the bands as needed. Remember this case was treated

over twenty years ago, it being the first of its kind that I had ever treated, and I resorted to methods which today might be questioned.

After anterior teeth had been drawn distally, and the bite had "jumped," a twenty gauge wire was adjusted in the hooks in place of rubber bands. A partial gold plate was made supplying the missing teeth. Fig. 3 shows the case before the missing teeth had been supplied.

I have watched this case for over twenty years, and you may ask, "Did the teeth stay in place?" I will tell you frankly they did not, but gradually

Fig. 4.—Case II.

changed to an end-to-end bite, and have remained in that position. The median line, however, is still in the center and the general effect is good, and the patient has an efficient occlusion. This case took over two years to correct.

CASE II.

A young girl, eighteen years of age, presented a mutilated case of Class I (Figs. 4 and 5).

Fig. 5.—Case II.

The dentist who had charge of this case since the patient was a child, told her he would straighten her teeth when she became older. (This is the patient's statement.) When she became eighteen, the inferior first molars were removed as well as the superiors, with the right premolar. Then as the teeth did not straighten themselves, the patient was told she was too old to have anything done.

I expanded the inferior teeth and bridged in the missing molars, with the

results shown in Fig. 4. While expanding the superior arch, I was able to pull the second molars forward, and close up the space occupied by the first molars. In Fig. 5 the case is shown partially completed; the model of the completed case was destroyed by an accident. A case mutilated like this is much harder to treat than if all the teeth were present, it being a great mistake to extract any tooth in this type of case. The superior wisdom teeth have erupted, holding the second molars forward very nicely.

CASE III.

Case 3 is a young man, nineteen years old, showing a Class I case (Figs. 6 and 7).

Fig. 6.—Case III.

The superior right canine had erupted outside of the arch, the labial surface was decayed from the gingival to the incisal edge, and was extremely sensitive, and the molars and premolars were improperly filled.

The patient was working at a small salary, and the only time he could come to my office was during his noon hour. In this case I advised the removal of the canine. The third molar erupting, closed the space completely,

Fig. 7.—Case III

no appliance being placed on the superior teeth. The inferior left second premolar was badly broken down and had an abscess on the root, consequently that tooth was also extracted. The inferior left canine and first premolar were forced back, and the space closed, allowing room for the centrals and laterals to be brought into position. The canines were banded, and an eighteen gauge wire was soldered to the lingual side of the bands, which has retained the teeth in position. Figs. 6 and 7 show the results.

It seems to me that under the conditions, I did the only practical thing, although I dislike to extract a tooth.

CASE IV.

Case 4 is interesting to me in this way,—the patient was a little girl, ten years of age, and had never been to a dental office before. The first molars were practically all gone, and there were eighteen deciduous teeth, and the roots of the first molars present. They were all removed, but not at one time. (Figs. 8 and 8*A*.)

Fig. 8.—Case IV

Fig. 8*A*.—Case IV.

This was a charity case and no appliance was adjusted. The patient was instructed to press forward on inferior laterals with her tongue. Fig. 9 shows the results one year later.

This case illustrates very well how teeth may become irregular by keeping the decidous teeth too long, as the permanent teeth, erupting at the line of least resistance, will be deviated by them. Fig. 8*A*, illustrating the superior

Fig. 9.—Case IV

Fig. 9*A*.—Case IV.

teeth, shows this very nicely. The deciduous lateral being retained, the permanent lateral erupted inside the arch.

The last time I saw this patient, which was about three years after the extraction she had a very efficient occlusion (Figs. 9 and 9*A*).

CASE V.

Figs. 10, 10*A*, 11, and 11*A* illustrate the case of a young man nineteen years of age with a mutilated case of Class II (distoclusion). He was work-

ing his way through college, and had very little time to devote to the care of his teeth.

When I saw the case it was badly mutilated, with the loss of the inferior first molars, the second molars badly broken down, and the left premolar was erupting outside of the arch just under the mucous membrane (Fig. 10*A*, left). The inferior right second premolar erupted inside the arch. The superior

Fig. 10.—Case V.

first molars were banded, expanding the canines and premolars, and the centrals were brought into position. The inferior second molars were banded and the six anterior teeth were brought forward, and a space for the inferior left first premolar was opened up.

By the time the space was wide enough, the first premolar on the left had erupted into position. The second premolar on the right was brought into

Fig. 10*A*.—Case V.

line, and intermaxillary elastics were adjusted. The second molars were brought forward to close up the space where the first molars had been extracted (Fig. 10*A*, right).

About this time the third molars began to appear. They came forward in line of least resistance, and held the second molars from dropping back. The appearance of the mouth at this period is shown in Fig. 11. The use of intermaxillary elastics was continued until the case was completed, as seen in right of Fig. 10.

While it is impossible to get perfect occlusion in these mutilated cases, I know that I have improved the occlusion and the appearance of this mouth.

CASE VI.

This patient was a girl, thirteen years old, presenting a Class III (mesioclusion) case complicated by the failure of the upper laterals to develop (Fig. 12). This case is shown to illustrate a method of bodily moving the teeth with the ribbon arch.

Fig. 11 —Case V

Fig. 11A —Case V.

The first molars were banded, and the ribbon arch adjusted, the anterior part of the arch being made of twenty-four gauge clasp metal, so there would be no lateral movement when the ribbon arch was adjusted into a three-sided box soldered to the labial surface of bands on the centrals. (The arch I used in this case is shown at the bottom of Fig 12.) In this case, the canines erupted beside the centrals, an x-ray showing no laterals present. The arch was expanded and the two centrals were carried bodily forward by tightening the nuts of the ribbon arch.

I have used this method for fifteen years, and have found it very efficient to move the apices of the teeth forward. After the centrals were carried for-

ward into position (Fig. 12), two laterals were bridged into place with the lingual wire running back, spreading the arch. Then intermaxillary elastics were adjusted to bring the superior arch forward, and the inferior arch backward into normal occlusion. This case was treated in 1909.

CASE VII.

A girl, seventeen years old whose teeth were improperly filled, presented a Class II case as shown in Fig. 13.

The superior first molars were banded, the wire adjusted, and the cuspids and premolars on each side expanded to obtain room to bring the superior left

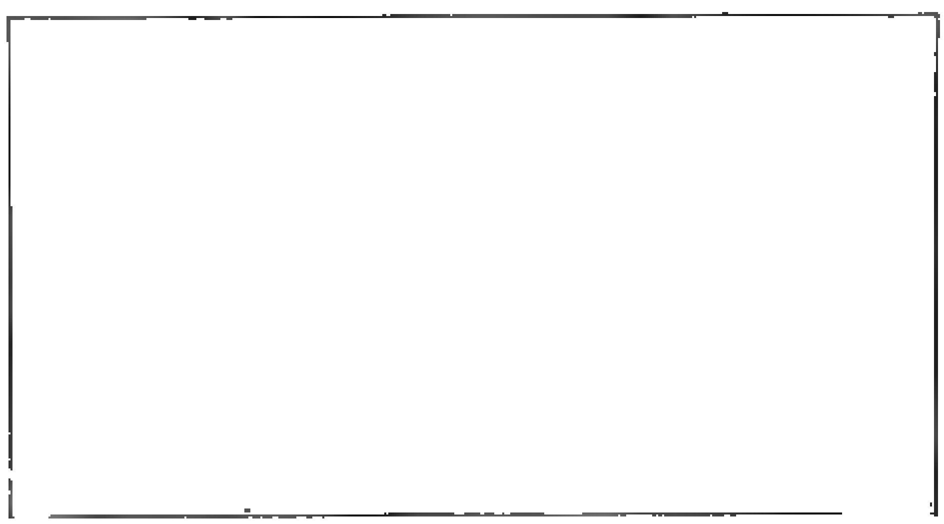


Fig. 12.—Case VI.

Fig. 13.—Case VII.

Fig. 14.—Case VII.

lateral forward into line. The inferior first molars were banded, and six anterior teeth were brought forward. Then intermaxillary elastics were adjusted and good occlusion obtained. The lower third of the superior centrals was missing, so they were crowned (Fig. 14). Occlusion has been made efficient, although not perfect, and the appearance of the mouth is greatly improved.

CASE VIII.

A man, twenty years old, Class III (mesioclusion). The superior right second premolar was missing, and the deciduous molar was firmly in place. The inferior molars and premolars were improperly filled. (Figs. 15 and 16.)

This man was also working his way through college, and had very little time from his studies to give to the care of his teeth.

All of the four first molars were banded and arches adjusted, but movement was extremely slow, and his time so limited, that as a *last resort,* the inferior right and left first premolars were extracted (Fig. 16). Then the whole force of the intermaxillary elastics was put on the six anterior teeth, and they immediately began to move back until the canines were in contact with the

Fig. 15.—Case VIII.

Fig. 16 Case VIII

second premolars, completely closing up the space occupied by the first premolars. While this was taking place, the superior anterior teeth were moving forward, and the bite jumped (Fig. 17). The appearance of the mouth has been greatly improved, and the profile is nearly normal (Fig. 18).

In retaining this case, the superior right and left cuspids, and first molars were banded, and lingual wire soldered to the four bands, with hooks on the buccal surfaces of the molars, so that the rubber bands could be adjusted to

hooks on the labial surface of inferior right and left canine bands. The right and left inferior molars and canines were banded, and a wire soldered to the buccal surfaces, running round the labial surface of anterior teeth as shown in Fig. 16.

Fig. 17.—Case VIII.

Fig. 18 Case VIII

So far the case has been very easy to retain, and I am satisfied that under the circumstances, I did the only thing practical. I dislike to extract teeth in such cases, but where patients have not the time, and the age is unfavorable, the appearance and efficiency of the occlusion in most cases can be greatly improved.

TECHNOLOGY IN ORTHODONTIA*

By Gilbert Dudley Fish, C.E., New York City.

THE influence of technology on orthodontia demands your attention. Engineering methods, applied in the diagnosis and the treatment of malocclusion, are producing results which mark the passing of empiricism in orthodontia. Where an art has stood, there is growing up a science.

It is true that the underlying causes of deformities of the dental arch are yet obscure. There can be no doubt, that any light which may be thrown upon the origin of these developmental aberrations must come through biological research. We are agreed, that the behavior of living tissue under specified treatment can not be exactly determined in advance.

Yet it must be admitted, that the only known means of correcting deformities of the dental arch, are fundamentally mechanical. It is axiomatic, that teeth, the surrounding tissues, and any appliance attached to the teeth, are all governed in common by the immutable laws of the exact physical sciences. It can be demonstrated, that the analytical problems in mathematics, physics, and animal mechanics, underlying the orthopedic treatment of malocclusion, can not be rationally handled, or even intelligently studied, by men unversed in technology. Wherefore I urge you to consider well the question of informing yourselves as to the rudiments of mechanics. Provide the students in your schools of orthodontia with instruction in the subject.

I admit, that it will not be easy to give the dentist, trained in subjects far removed from technology, a grasp of the fundamentals of kinematics and dynamics; but I insist, that the necessity has arisen and must be faced.

There can be no doubt, that the awakening of the public to the meaning of orthodontia, will give rise to a world-wide demand for early treatment of children. It is not visionary to believe, that orthodontia is destined to be the beginning and the end of the dentistry of the future. You, as specialists, have the advancement of this subject in your hands. I wish to plant in your minds the idea, that another science, older than your own and further developed, holds a great store of information which you require for your further progress.

It is my purpose today to illustrate a few applications of mathematical science in orthodontia, not with the idea of offering instruction in mechanics and allied subjects, but in order to suggest to you that technology is a vast field, offering limitless opportunity for research.

Mechanics is not the trade of an artisan; it is a major division of physics. Mechanics bears about the same relation to the shop-work of the so-called "mechanic," as engineering bears to the work of the locomotive engineer.

The partition of mechanics into natural divisions, is illustrated schematically by Fig. 1. Kinematics is the science of motion, considered without reference to the forces involved. Dynamics is the science of force and other circumstances of motion. Kinetics is that part of dynamics dealing with variable

*Read before the Alumni Society of the Dewey School of Orthodontia, Chicago, Ill., March 14, 1917.

motion. Statics is that part dealing with uniform motion, including the special case known as "rest."

The problem of predetermining the occlusal arch falls naturally into the department of kinematics, which is the calculus of motion. Motion, kinematically speaking, is purely relative, and consists in change of position of two or more bodies with respect to one another. Motion at any instant is measured by velocity, the magnitude of which is the time rate of change of position. In the case of motion of translation, which is bodily displacement independent of rotation, the line of action of the velocity defines at any instant the line along which the motion of translation is occurring. In the case of motion of rotation, which consists in turning about an axis independently of translation, the axis to which the angular velocity is referred is the axis of rotation.

- MECHANICS
  - KINEMATICS
  - DYNAMICS
    - KINETICS
    - STATICS

Fig. 1.

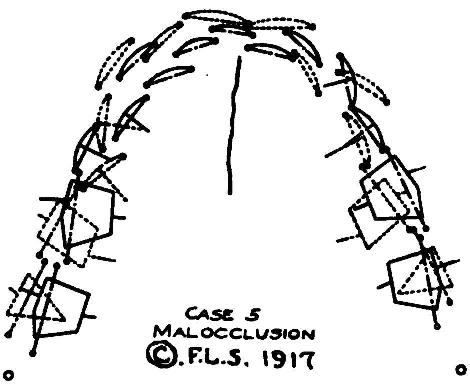


Fig. 2.

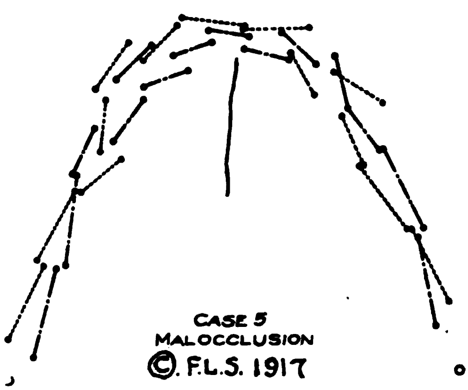


Fig. 3.

In describing the motion of a body, it is necessary to specify to what other body the motion is referred, unless the same is tacitly understood. When a train approaches Chicago, is it not true that Chicago approaches the train? It is convenient to consider Chicago stationary and the train in motion, because Chicago is a fixed part of the earth, which is the natural ultimate reference body for motions incidental to terrestrial affairs. When a soldier is hit by a bullet, the impact is mutual, though the effects may be one-sided. If it is said, that both soldier and bullet are in motion at the instant of meeting, but that the bullet is moving the faster, it must be inferred that the motions are referred to the earth, otherwise there can be no significance in the remark.

A man walks down the aisle of a train, conversing. His mandible is in motion. What is meant by this observation? That his mandible as part of the solar system, is traveling through interplanetary space at so many miles per second? That it shares the orbital and axial motions of the earth? That

it is approaching Chicago at a mile a minute, or nearing the rear of the train at four feet per second? Or does it mean that, as an attachment of the head it is nodding and swaying as the head nods and sways? No. All of the above circumstances exist in fact simultaneously, but not one of them is inferred by the remark that the jaw is in motion. It is only the motion mutually existing between jaw and skull that is considered.

Arch predetermination is a kinematic problem. The solution embraces the prediction of the relative positions of the teeth when placed in occlusion according to the specifications governing occlusion. The solution does not include the determination of the movements of the teeth in reference to the skull, but shows only the displacements and rotations of the teeth in relation to one another. Let me illustrate:

Fig. 2 shows an orthographic projection of a denture in malocclusion. The superiors appear in dotted lines and the inferiors in solid lines. To make the diagram less confusing, let us remove all lines except those joining the approximal contact points. In Fig. 3 the teeth in malocclusion are depicted by straight lines, these lines being projections of the mesio-distal diameter lines.

Let us suppose, that by solution of the kinematic problem of arch predetermination for this case, we ascertain the form and dimensions of the occlusal arch. This involves, among numerous other requirements, the joining end-to-end of the diameter lines for the upper denture and also for the lower. The occlusal arch for this case is shown in Fig. 4.

With this chart and the maps of malocclusion both at hand, we are in position to study the relative tooth movements involved in the change from malocclusion to occlusion. To facilitate this, we superimpose one map over the other, so as to see, simultaneously, the malocclusal and the occlusal positions of the teeth. In Fig. 5 is shown, as a result of bringing these maps together, the change in form of the upper arch and the relative movements of the upper teeth. Fig. 6 shows the corresponding changes in the lower denture.

If at this point you ask, "Why place the maps of occlusion *in that particular position* with respect to the maps of malocclusion?" I reply that any other placement would show exactly the same movements of all teeth, upper and lower, in relation to one another, and that the relation of arches here shown is merely my estimate of the placements which reveal most *simply and clearly* the tooth movements.

Figs. 7 and 8 are the same as Figs. 5 and 6, respectively, except for the restoration of the conventional tooth forms. Fig. 9 shows the arch of occlusion with tooth forms represented in the same way.

The significance of the relativity of motion in this problem of plotting tooth movements, is that we are not dependent upon so-called "fixed points" from which to measure. It is not necessary that we know in advance the ultimate location of the occlusal arch in relation to the skull, for in the treatment of malocclusion we are confined to the teeth themselves for anchorage. In fact, precise advance information in regard to the resistance of the alveolar process to movement of the teeth would not provide us with any means for moving the dental apparatus bodily in its foundations, if we limited ourselves to appliances contained wholly within the mouth.

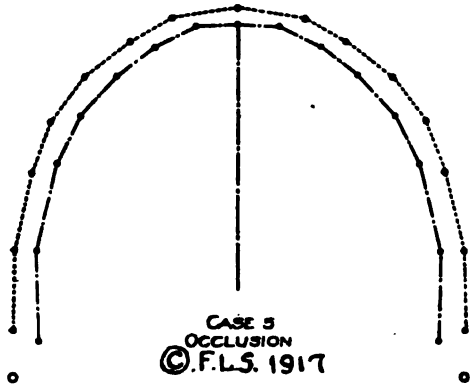


Fig. 4.

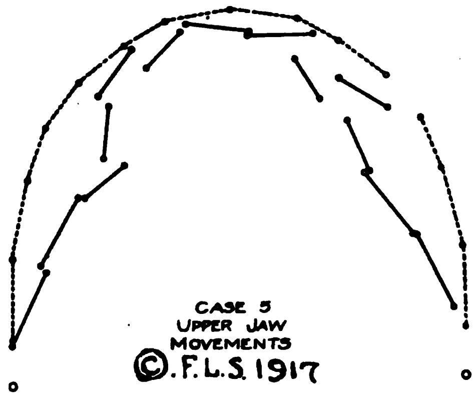


Fig. 5.

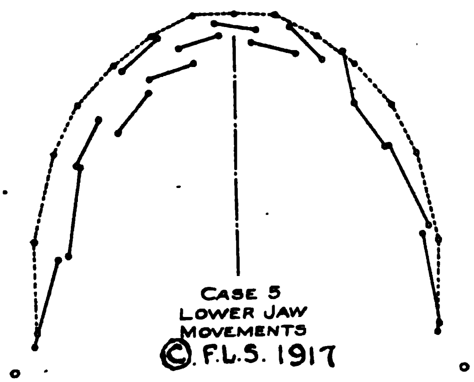


Fig. 6.

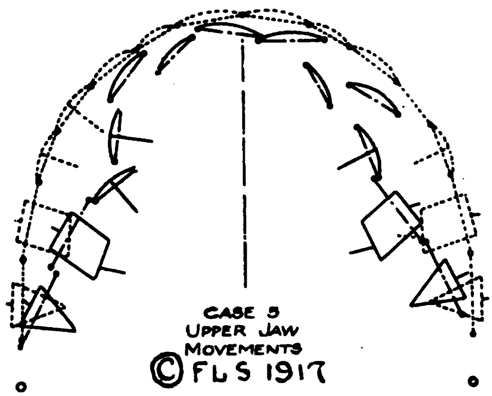


Fig. 7.

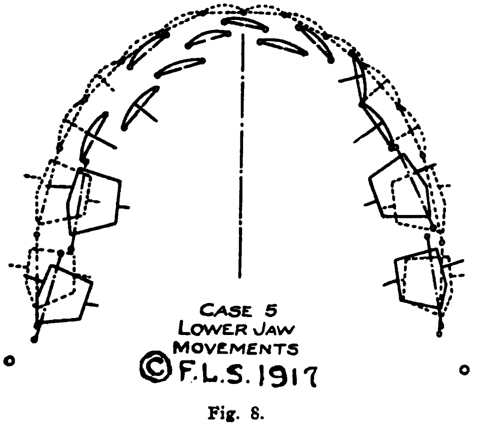


Fig. 8.

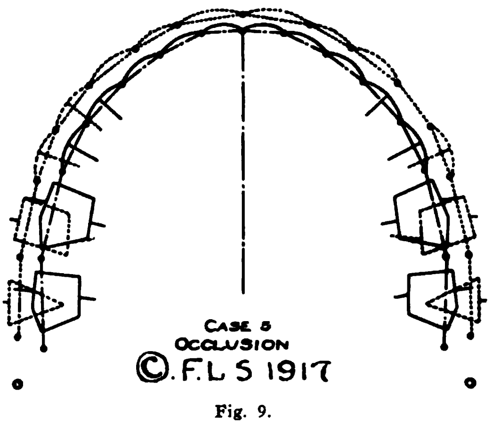


Fig. 9.

For divers reasons it would be highly advantageous to have means of studying tooth movement in relation to the skull. An instrument which will fill this need and others as well, the *projecting craniograph,* has been invented and designed in detail. Circumstances, too painful to dwell upon, have thus far prevented the placing of the order for the construction of this instrument.

When we approach the subject of appliances for moving teeth, we find ourselves in the realm of dynamics. According to the fundamental laws of dynamics, announced by Isaac Newton, the following principles are of universal application:

Every action of force sets up an equal and opposite reaction; and every body or particle of matter is possessed of inertia, whereby it maintains rest or uniform motion when not acted upon by any unbalanced force; and whereby it suffers a change of motion upon application of an unbalanced force, said change of motion, otherwise called *acceleration,* taking place in the direction of the force, at a rate directly proportional to the magnitude of the force, and inversely proportional to the mass of the body.

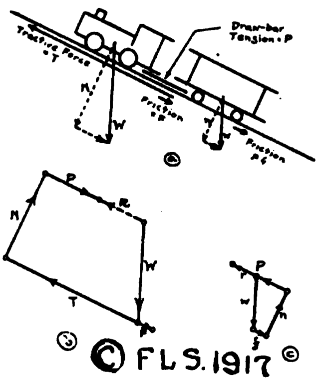


Fig. 10.

When an appliance presses against a tooth, the tooth presses back against the appliance with equal intensity. Lest you should find it difficult to reconcile this principle with the fact that the tooth moves under this influence, let me call your attention to a locomotive starting a train up a grade.

Fig. 10 shows a locomotive and a car on a steep slope. If there is enough steam in the cylinders to hold the train against rolling downhill, but just insufficient to start it uphill, then the train is in equilibrium, and all forces are balanced. The forces acting on the engine are its weight *W;* the normal reaction of the rails *N;* the friction of rails against drivers, which friction is the longitudinal reaction to the tractive effort induced by the steam pressure; and the backward pull of the draw-bar. The forces acting on the car are its weight *w;* the normal reaction of the rails *n;* the friction of rails against wheels, acting downhill; and the forward pull of the draw-bar. The draw-bar pull, referred to in both cases, is simply the tension in the connection between engine and car. If now the steam pressure be raised, the tractive effort will increase, and there will be a corresponding jump of the draw-bar pull. This force will be in excess of the forces tending to hold back the car, and motion up-hill will com-

mence. The rate of acceleration will be in direct proportion to the unbalanced pull in the bar, and inversely proportional to the inertia of the car. At every instant, the car pulls back on the engine exactly as hard as the engine pulls on the car, by the laws of action and reaction; the car moves, because this pull exceeds the other external forces holding back on the car. The difference is manifested by the acceleration imparted to the car.

The same principle applied to the case of the appliance pressing against the tooth, shows that the question whether the tooth moves against the resistance of the medium in which it is embedded is decided by whether the active force applied to the tooth exceeds the resistance developed by the alveolar process—not by whether the active force exceeds the reaction of the tooth, for that could never happen. The infinitesimal difference between the active force and the resistance of the foundation is responsible for any tooth movement which takes place.

Bodies at rest are in equilibrium; i.e., are not acted upon by any unbalanced force or couple. An explanation of the term "couple," and a statement of the conditions of equilibrium, will be given later.

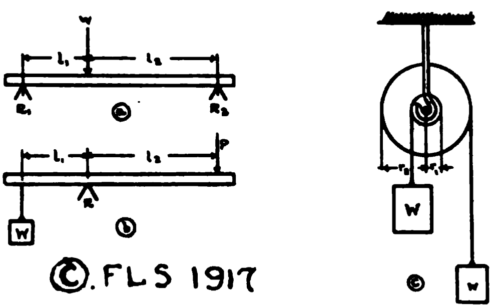


Fig. 11.

Inasmuch as the relative motions of the parts of an appliance attached to the teeth are exceedingly slow, the appliance may be considered in equilibrium. This principle is a valuable one in appliance design, because it enables the designer to apply the laws of equilibrium and so analyze the reactions between appliance and teeth. In fact, because the appliance may be regarded as stationary, the analysis of the forces involved falls under the head of *statics* instead of *kinetics*.

In order to understand the laws of *equilibrium,* or *balance of forces*, it is necessary to know the meanings of the words *couple* and *moment* as used in mechanics. A couple is simply a pair of parallel forces, acting on the same body, equal in magnitude but opposite in direction, which do not meet. The tendency of a couple is to induce *rotation without translation*. The measure of magnitude of a couple is the product of the amount of either force, multiplied by the distance between their parallel lines of action; this is called the *moment* of the couple.

Any completely known system of forces, acting upon a rigid body, may be considered replaced by a single force and a single couple, as far as the motion of the body is concerned. This force and this couple may be determined by a

routine process. If force and couple both prove to be nil, then evidently there is no ***resultant*** force to accelerate the body in translation, and no resultant couple to impart angular acceleration. In this special condition, the body is in equilibrium, whether it be in motion or at rest.

Fig. 11 contains three figures illustrative of the principle of moments, otherwise called the *law of the lever*. A beam simply supported at the ends, carrying a weight at an intermediate point, is represented by *a*. By the principle of moments, the system being in equilibrium, the left reaction R_1, which must act vertically upwards, is equal to the weight W multiplied by the distance l_2 and divided by the span l_1+l_2; similarly R_2 is $W \times \frac{l_1}{l_1+l_2}$; the sum of R_1 and R_2 equals W. A cantilever beam, or lever of the first class, is shown at *b*. If P is an active force and R the reaction of the fulcrum, then, whether the lever is in equilibrium or rotating about the fulcrum, the action of P is transmitted by the lever to the cord holding the weight W, and induces in the cord a tension equal to $P \times \frac{l_2}{l_1}$; if the tension equals the weight W, then P and W balance each other; if the tension exceeds W, the weight is raised; if W exceeds the tension, the weight descends; in any case, the fulcrum reaction equals P plus the tension in the cord. A wheel and axle combination is shown

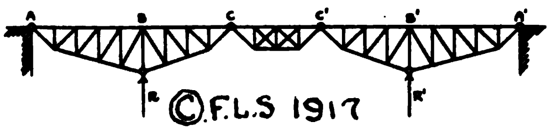


Fig. 12.

at *c*. If the system is to be in equilibrium, the ratio of the large weight to the small one must be the same as the ratio of the radii of the wheels, $r_2 : r_2$.

When an appliance attached to two or more teeth presses against or pulls on them by virtue of its elastic deformation, the teeth react against the appliance; these reactions are exactly equal and opposite to the forces exerted by the appliance against the teeth. If the material, sectional dimensions and form of an elastic wire appliance be known, and also its elastic deformations when in place, and in addition the exact nature of each attachment or connection to band or crown, then it is possible to calculate the direction and magnitude of every reaction between tooth and appliance. The information above listed is available, if the number and arrangement of attachments be properly restricted, if the nature of the attachments be made to conform to certain requirements, and if the metal be not deformed beyond its elastic limit. While the above mentioned conditions are not realized in the appliances commonly met, it is possible to design appliances conformable to them.

Two considerations are held uppermost in designing an appliance, by engineering methods, to carry out predetermined tooth movements. One consideration, which is obvious, is that the appliance shall be structurally suitable for imparting to the teeth their required displacements. The other, which is *new thought,* is that the connections and the provisions for applying force shall be of such a nature that the internal stresses and the external forces of the

appliance can be calculated and shall be subject to complete and accurate control.

A device frequently employed in civil engineering is the hinge; its function is to serve as a connection without transmitting any bending stress. No force acts upon or is transmitted by a hinge, except direct thrust and direct pull. Inasmuch as the hinge has been made to serve the same purposes in orthodontic appliances as in engineering structures, illustrations of its application in both subjects will be given.

Fig. 12 represents a cantilever bridge. *AB* and *A'B'* are the shore arms; *BC* and *B'C'* are the cantilever arms; *CC'* is the suspended span. *A* and *A'* are the abutments, hinge connected; *C* and *C'* are the hinge connections supporting the truss *CC'*; *R* and *R'* are the supporting hinges on the piers. Hinges *C* and *C'* are structurally advantageous for reasons too technical to be explained here. It is interesting to observe, that if the structure were rigid instead of hinged at these points, the weight of a train on the shore arm *AB* would be felt as far away as the opposite shore at *A'*; as it is, no load between *A* and *C* can cause stress in any part of the bridge between *C* and *A'*.

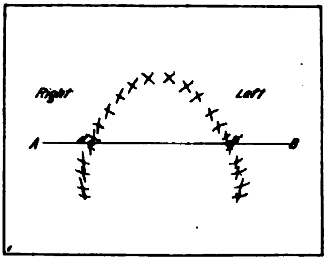


Fig. 13.

The most prominent feature of the hinges in this structure, is that their use in the design of the bridge makes possible the calculation of the stresses in all members or parts, as well as the values of pier and anchorage reactions, under all conditions of loading. In other words, the hinges not only are a structural advantage, but they permit of economical design on account of the certainty and accuracy in calculation which they make possible.

While hinges used in bridges are horizontal, those used in orthodontic appliances are generally vertical. This is easily understood, when it is considered, that whereas the forces acting on a bridge are verticle, most of the reactions on appliances are horizontal. Vertical hinges allow freedom of horizontal rotation, but prevent all other rotation.

An expanding arch of elastic wire, connected to the other parts of the appliance by vertical hinges at the ends, and touching nothing else but those two hinges, can exert no horizontal force other than direct expansive force along the straight line joining the two hinges. If the other parts of the appliance are two yokes attached to the side teeth, one yoke right and the other left, it is possible, by properly locating the hinges which connect expander and yokes, to control completely the movements of the side teeth. The location of a hinge anterior to the center of resistance of the set of teeth attached to a

yoke, provides for greater movement of the bicuspids or temporary molars than of the posterior teeth. If the hinge be placed at the center of resistance, the side unit moves out without rotation. A posterior location of the hinge means greater movement of the molars than of the teeth anterior to them. Needless to say, a well made vertical hinge effectually prevents tipping of the teeth during expansion.

Time limitation prevents me from multiplying examples of the practical use of hinges in orthodontia, and excludes even brief reference to many other interesting applications of engineering principles to appliance design. Enough has been shown to indicate that it is considered of primary importance to have the action susceptible of accurate calculation, so as to avoid undue pressures and movements in wrong directions. Of course, the possibilities of such appli-

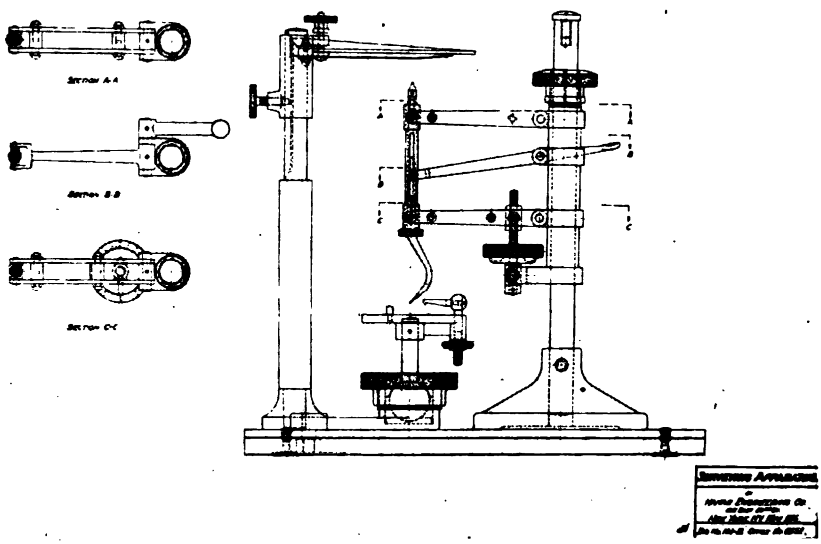


Fig. 14.

ances are not realized unless they are used in connection with accurate maps showing the predetermined tooth movements.

We have so far considered only external forces. Let us look into the internal stresses in elastic wires. The subject of internal stresses and elastic deformations of metal structures is highly mathematical. All internal stresses may be resolved into *direct stress* (tension or compression) and *shear*. Bending stress is a combination of tension and compression; torsive stress is a form of shear.

By Hooke's law, deformation, or strain, is directly proportional to the stress accompanying it, within the limit of elasticity of the material. By the theory of flexure of elastic materials, the condition of stress at any point in an elastically deformed wire of any shape, can be calculated mathematically, provided the deformation be completely described and the material and dimen-

sions of the wire be known. Subject to certain restrictions, the reactions between such a wire and its attachments can be computed. In other words, the directions and amounts of the forces exerted by an appliance against the teeth or other parts to which it is attached, or with which it comes into contact, are susceptible of calculation, provided certain general principles of design be observed.

An interesting application of the theory of elasticity, is an artifice for minimizing the shortening of a wire arch during expansion. The common dif-

Fig. 15.

ficulty due to the tendency of a buccal wire to press against the front teeth or to bury itself in the gum, may be eliminated by using heavy gauge wire in front and light wire, ending in long flexible extensions, on the sides; the great stiffness of the front as compared with the sides of the arch, causes most of the deformation to occur in the sides. The foregoing is more readily appreciated if it is realized that the deformation of a wire under stress varies inversely as the fourth power of the diameter; i.e., doubling the thickness multiplies the stiffness sixteen-fold.

To present a cursory review of the development of orthodontic surveying, the following series of pictures are illustrative of obsolete and current methods.

Fig. 13 is a reproduction of a map made directly from a model by the use of ordinary dividers. By this method, Frederick L. Stanton was able, in his early investigations, to plot on paper fairly accurate maps of the cases he was studying.

Fig. 14 is a drawing of the dental surveying apparatus designed by Rudolph Hanau according to specifications made by Stanton. This instrument marked a great advance over dividers. It is in use today for making orthographic

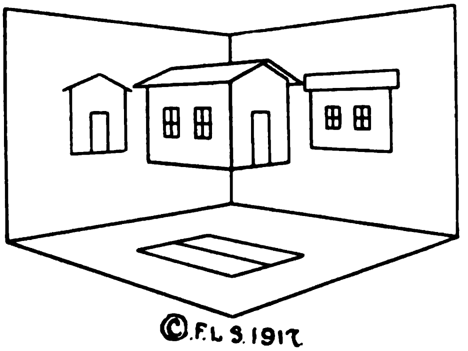


Fig. 16.

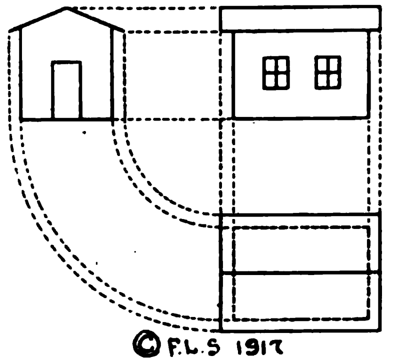


Fig. 17.

projections from models, and for measuring elevations. Fig. 15 is a photograph of this instrument in use.

Figs. 16 and 17 are illustrative of the principle of orthographic projection. All parts of the object are transferred to planes of projection by straight lines at right angles to those planes. This kind of projection reproduces to full scale all dimensions parallel to the projection plane. Photography projects in perspective, which does not, in general, reproduce to scale.

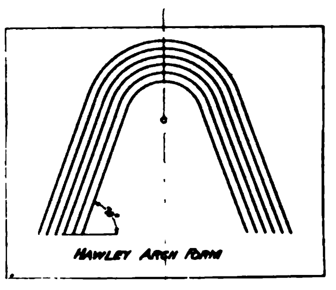


Fig. 18.

To introduce the subject of arch predetermination, I shall make the following general statements. The normal dental arch is individual for every person. The variation in form of arch among the various races is very wide; although the maximum variation in width of arch across the superior first molars is only about 18 per cent, the range in altitude from upper central incisors back to a line across the first molars is in the neighborhood of 50 per cent of the middle value. A given individual's teeth, if susceptible of normal occlusion, can occlude normally on one arch form only; a very slight variation

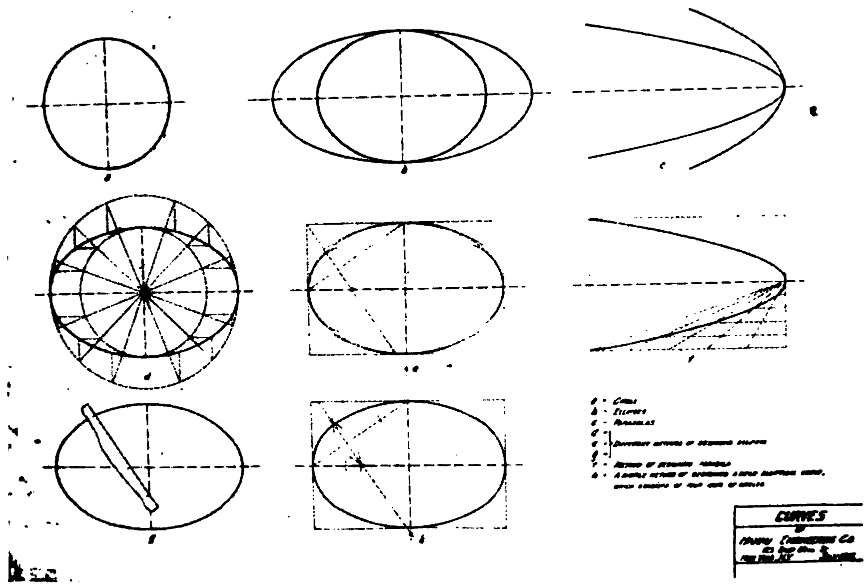


Fig. 19.

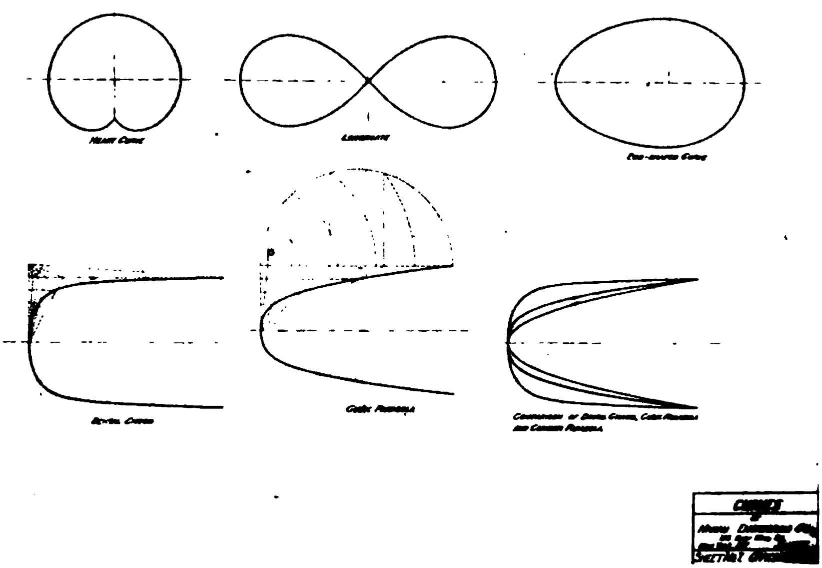


Fig. 20.

in the dimensions of the individual's occlusal arch is permissible, due to flexibility of the conditions or requirements of normality. The human eye is incapable of estimating the dimensions of the occlusal arch, which depend on the shapes and sizes of the teeth themselves; the eye can not even pick out those cases of malocclusion, in which the size of the teeth will make normal occlusion impossible.

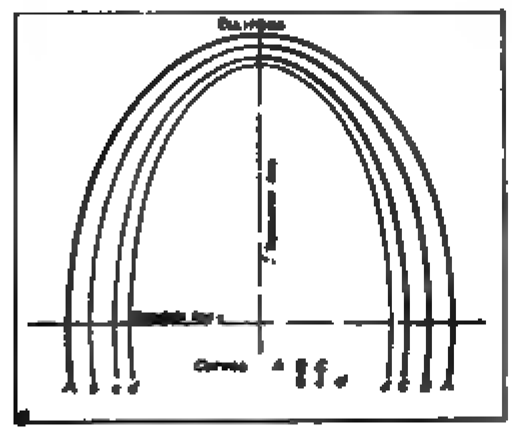


Fig. 21.

Fig. 22.

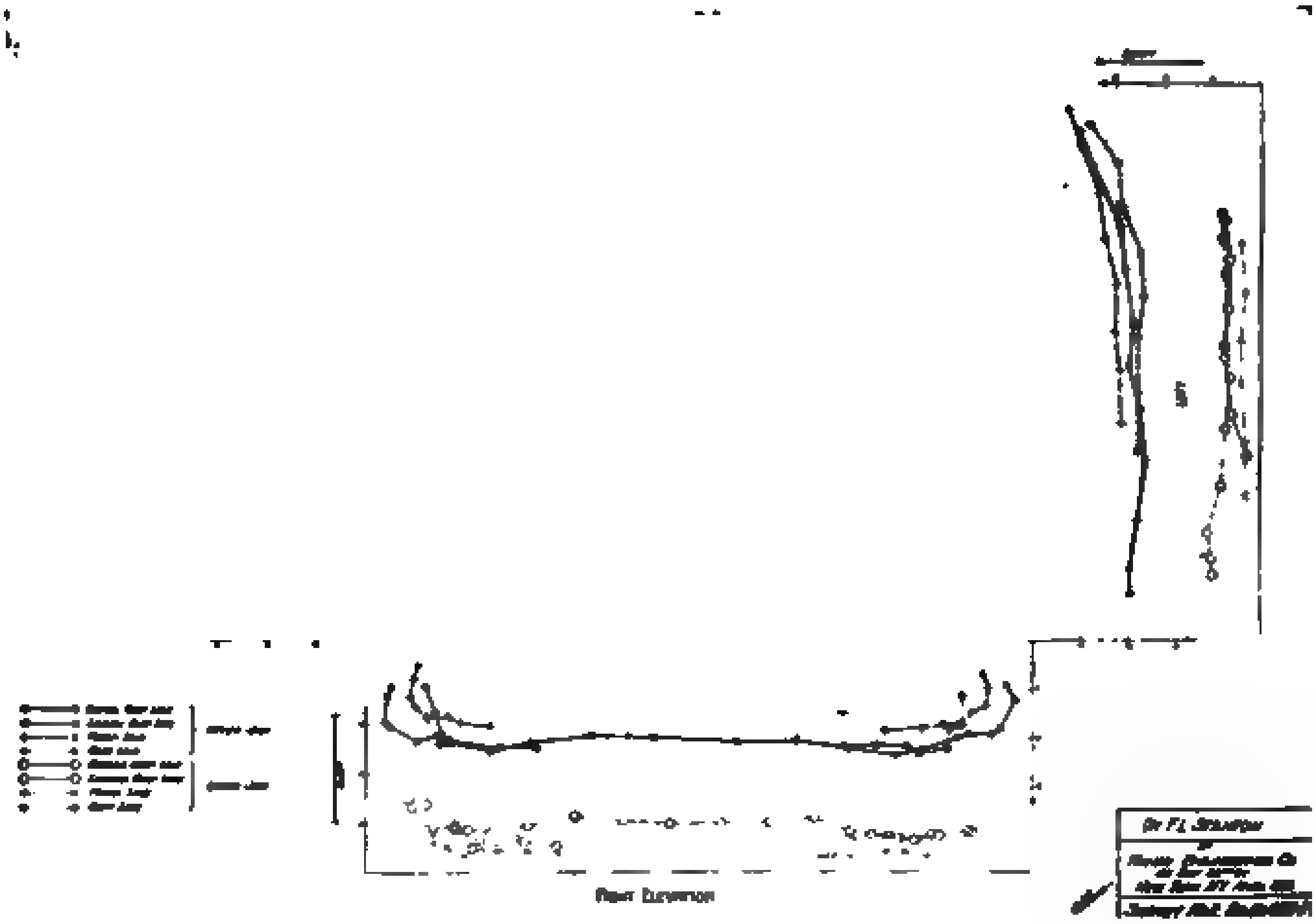


Fig. 23.

Fig. 18 shows a conventional form of arch which for a long while was used by many orthodontists as a pattern. The Hawley arch varied in size, but was always of the same shape. In view of the variety of shapes found in normal skulls, any such guide is seen to be incorrect in principle.

Figs. 19, 20, and 21 show mathematical curves used by Hanau for predetermining occlusal arches. These investigations were profitable and led to the production of some very accurate plans.

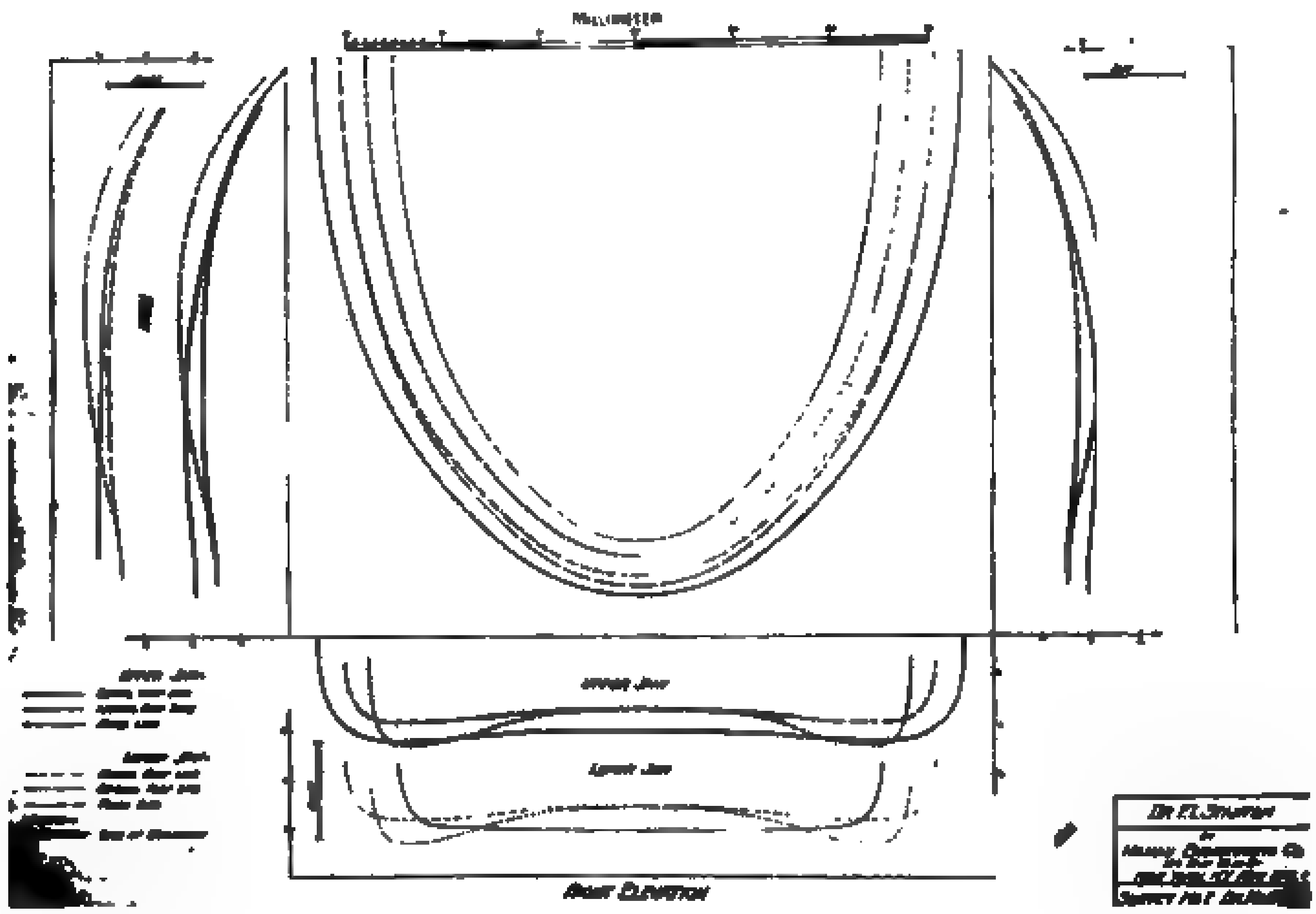


Fig. 24.

Fig. 25.

Figs. 22, 23, and 24 show models, survey maps, and the ideal curve, respectively, for a case of natural occlusion that was nearly normal. Figs. 25, 26, and 27 similarly illustrate a case of pronounced malocclusion. The surveying for these two cases was done by Hanau.

The surveying process of today involves the use of a mechanism, or kinematic linkage, in place of a method of trial by mathematical curves. The steps in the procedure are as follows:

The models are surveyed with the projecting instrument already illustrated. The maps are enlarged tenfold with a pantograph, shown in Fig. 28. The individual teeth are measured with every precaution under a micrometer

microscope as shown in Fig. 29. The tooth sizes are reproduced, to tenfold scale, in the occlusograph (Fig. 30). The normal occlusion of upper and lower molars and bicuspids, and a suitable overlap relation in the incisal region, are carefully ascertained, so that the cross-link connections of the occlusograph

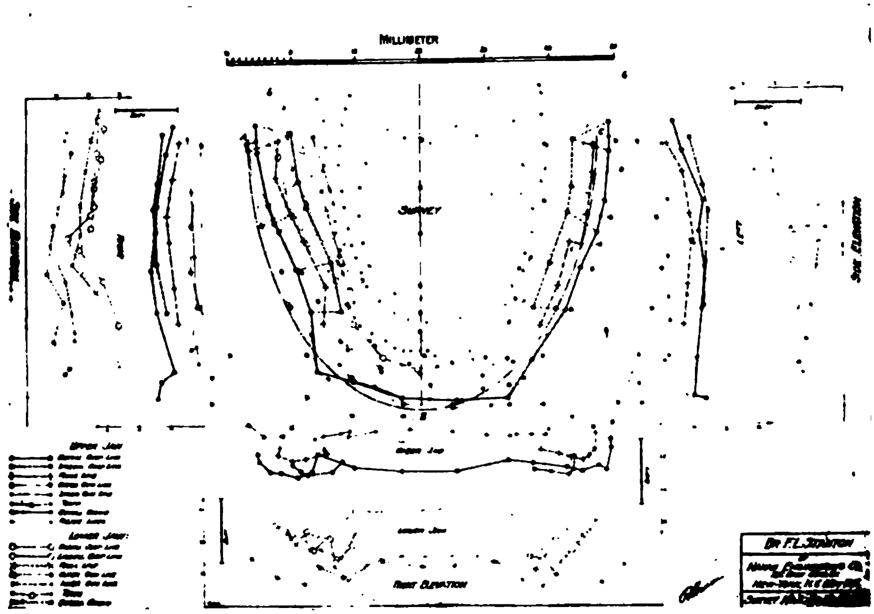


Fig. 26.

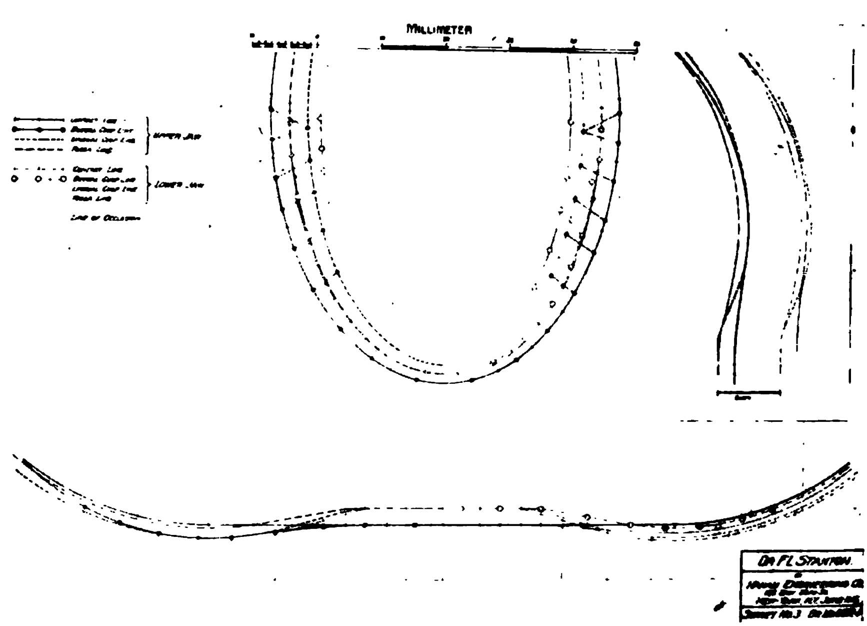


Fig. 27.

Fig. 28

Fig. 29.

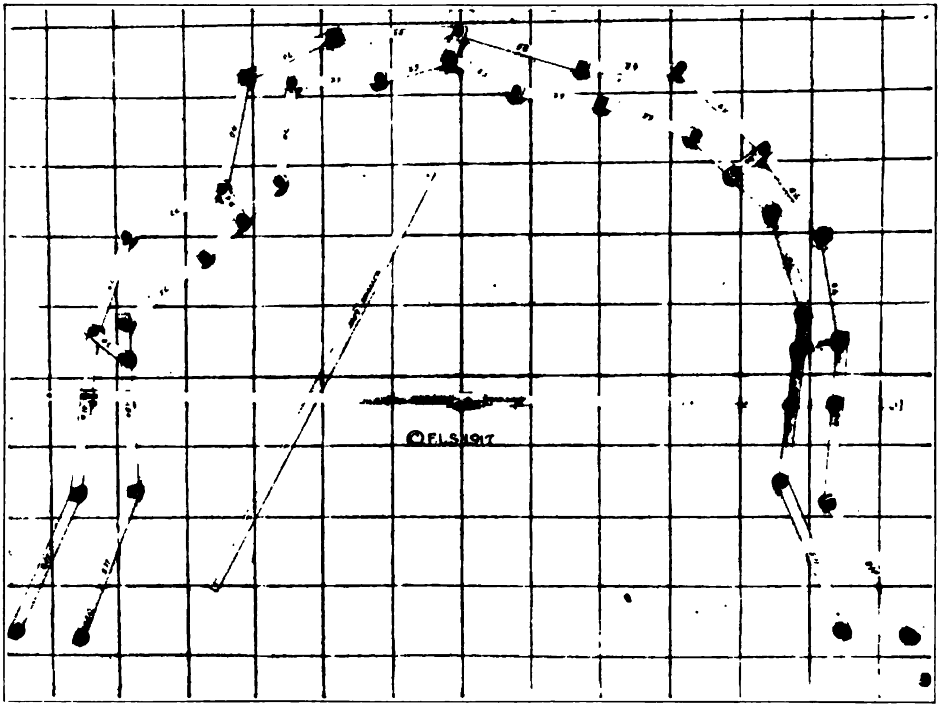


Fig. 30.

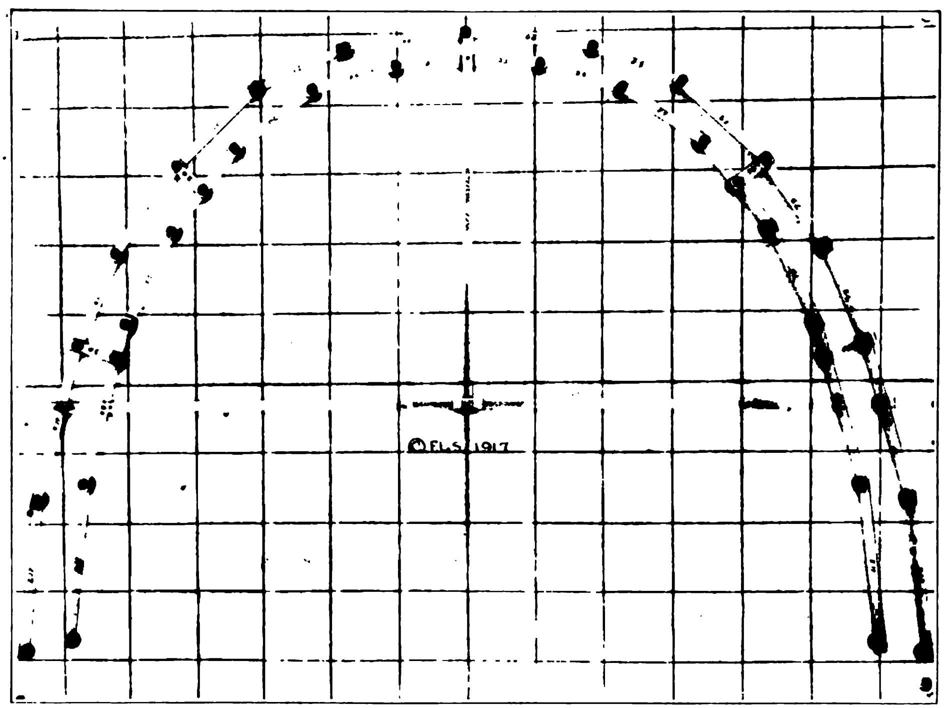


Fig. 31.

shall be determined. The occlusograph is then smoothed out, and semiautomatically establishes the occlusal arch for the case in hand (Fig. 31). The occlusion map, which is made on transparent paper, is placed over the enlarged map of the malocclusion, so as to show the tooth movements required. The pantograph is again used, this time to reduce the composite map of malocclusion and occlusion to natural scale. The final product of the surveying process is a book of plans, showing malocclusion, occlusion, and all tooth movements.

No mention has been made of the supplementary process of showing the vertical, or up-and-down, movements, but the general process includes this phase.

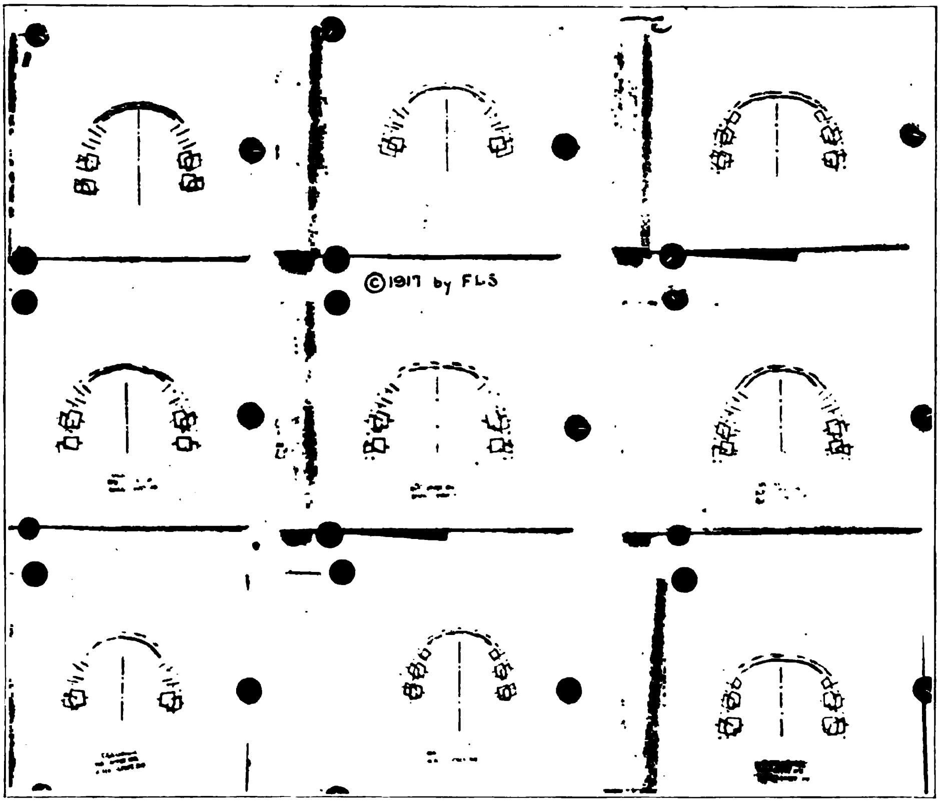


Fig. 32.

Fig. 32 shows nine books of plans, each open at the page on which is the occlusal arch. Note the variety in sizes and shapes. I have heard the criticisms, that these methods were too mechanical and insufficiently biological, and that this hard and fast process made all arches the same shape. Imagine such objections made by men whose only guide to occlusion was the Hawley arch!

One fundamental teaching of the new thought in orthodontia, is to the effect that occlusion is never established by the mere removal of irregularities and the suppression of symptoms. The final solution of the problem must depend on the prevention of malocclusion by early treatment of the deciduous arch.

A CONSIDERATION OF SOME OF THE ETIOLOGICAL FACTORS OF MALOCCLUSION*

By Martin Dewey, D.D.S., M.D., Chicago.

In selecting as my topic, the consideration of some of the etiological factors of malocclusion, I do so because I believe that the most important part of the study of any pathological condition is its origin or cause. According to this plan, we then place malocclusions among pathological conditions, which may be a manner of considering them that you have not thought of before. Not only is the study of the etiological factors important to the science of orthodontia, but more attention should be given to the study of etiological conditions which arise in the practice of dentistry than has been given in the past. In speaking of dentistry in general, nothing has retarded the progress of scientific dentistry so much as has the lack of the study of etiological factors. The great object in dentistry in times past has been the treatment of conditions as they were found; the correction of deformities and the correction of defects without stopping to consider what has caused these conditions. Papers read before dental societies which have considered etiological factors, have received very little attention while those dealing with methods of treatment have had large audiences. I know because I have given both kinds. Even in orthodontia the paper which deals with the treatment of malocclusion receives a more cordial reception than the one dealing with causes. However, knowing these things and knowing that the cause of malocclusion is still a disputed field, I am going to present to you a few factors which I hope you will find interesting.

In order that I may better present the subject I will begin with the classification of the causes of malocclusion according to the time and manner of their origin, and will follow a plan that is followed in the classification of other conditions.

Conditions, be they normal or pathological, can be grouped as follows:

TIME		MANNER
Inherited Congenital Acquired	CAUSES OF MALOCCLUSION	Local Constitutional

Considering that group of etiological factors as they are arranged under time, inherited conditions may be defined as those arising in the offspring, which have been transmitted from the parent. They include that large group of factors which are impressed on the germ cell, and which are supposed to be a part of the chromatin of the cell.

Congenital conditions are those which arise in the individual after the fertilization of the germ cells and make their appearance before birth. They may be inherited or they may be the result of faulty developments arising in the embryo for which the germ cells have not been responsible. They may be the

*From an illustrated lecture before the Alameda County District Dental Society, Oakland, Calif., February, 1917.

result of disturbed conditions in the economy of the mother which has influenced the development of the embryo after conception.

Acquired conditions are those which appear after birth and may be the result of environment. They are always the result of external circumstances and influences.

The relative influences of the three conditions of the life of the individual may be illustrated by the following diagram:

Germ cells
Inheritance > | Congenital | Acquired

The two lines on the left represent the male and female germ cells which make up the hereditary factors of each individual. At the time of the union of the male and female germ cells, the individual possesses everything that is possible to inherit. Everything which he inherits is also congenital, as the majority of conditions will make their appearance before birth. The racial and anatomical characteristics will appear. The individual will have a certain number of teeth, a certain number of eyes, hands, and feet. All normal anatomical conditions are both inherited and congenital. An abnormal congenital condition is one which arises after fertilization and during development, and which was not present in the parents. Some congenital conditions are developmental factors which occur in every individual, but are lost in the further development, while some become permanent in certain people. Harelip and cleft palate belong to this group. Every child has a divided lip and a cleft palate during development, but they are lost as normal development proceeds. If the clefts persist until birth this is called a congenital deformity. The actual time in the life of the individual when congenital conditions can make their appearance is but the nine months of pregnancy, while the time during which an individual can inherit anything is that period represented by the lives of his ancestors while the factors are represented only in the germ cells. After the germ cells unite, everything is then and there inherited that will ever be inherited.

Acquired conditions arise after the birth of the individual and may arise as long as he lives. It is possible for him to acquire something which he has not inherited, which was not present in the germ cells, and which was not the result of congenital influences. Acquired conditions are therefore the most numerous in the production of malocclusion.

Local conditions are those which affect the teeth and their surrounding structures directly and thereby produce malocclusions. A strictly local cause would therefore have to be an acquired condition.

Constitutional conditions are those which so affect the general metabolism of the individual as to influence the development of the teeth and the surrounding structures. Constitutional factors can, in the broad sense of the word, include inherited, congenital, and acquired conditions. However, from a pathological standpoint they are mostly acquired. Therefore we can divide acquired causes into local and constitutional.

In the consideration of a few of the conditions which have been mentioned, we will first consider those which have been placed under inheritance or have been termed hereditary. The early writing on the causes of malocclusion prac-

tically attributed fifty per cent of the malocclusions which were present to inherited conditions. As the question of inheritance was studied from a biological standpoint it was found that a great many conditions which were supposed to be inherited could not be inherited from a physiological standpoint. It was further found that some of the conditions which had been considered inherited were the result of constitutional conditions which were acquired early in life. However, there are a few factors which are constantly being brought up by some of the modern writers as being hereditary factors in the production of malocclusions which I can not agree with and which I will consider only from the negative standpoint.

The older textbooks laid a great amount of stress upon the influence of the mixing of races, and the intermarriage of different nations in the production of malocclusions. As this country has been settled by people of different nationalities the older writers were supposed to find an abundance of proof in the mouths of American children, and there were a large number of malocclusions present and there are a large number present at this time. In a current number of a leading dental magazine, this old theory has again found space and it is only because I have recently been consulted in regard to this article that I am taking the time to consider this theory. The intermarriage of different peoples has been believed to produce a condition which has been described as large teeth and small jaws, whereby the child is supposed to inherit the large teeth of one parent and the small jaws of the other. Those who support this theory have never explained how such a thing as that could occur. It must be remembered that man is only one part of the animal kingdom and is subject to the same biological laws and the laws of inheritance as any other animal. If it were possible to inherit the large teeth and small jaws, we should see equally as many small teeth and large jaws, which is not the case. If there could be the direct inheritance of parts from each parent, we should find large fingers on small hands and large arms on small bodies and various other abnormal conditions. These we do not find. In the crossing of other species we do not find that certain organs are transmitted directly from one parent and certain other organs from the other parent. There may be a blending of the two germ cells so as to produce an offspring that resembles neither parent; as the mule which is the result of a cross between the mare and jack; as the cattalo which is the cross between the cattle and the buffalo. We do not inherit our organs directly from our parents, Nature does not construct a new individual by taking certain organs from one parent and certain organs from the other, but by the union of the germ cells a new organism is started which must work out its own salvation. It has been proved by experiments on certain of the lower animals, that in the early stages of segmentation the cells have not taken on any definite function in the formation of organs. In the early stages of segmentation, it is possible to separate a frog egg and get two frogs where there should have been but one. This is probably what happens congenitally in the formation of some twins.

Another factor in the production of malocclusion has been termed the inheritance of family traits. Some claim that certain types of malocclusion can be transmitted from one generation to the other with the result that the patients,

will resemble their parents and that they can be identified by the malocclusion they possess. A certain royal family in Europe is always quoted as possessing a certain type of mandible which is supposed to be characteristic of that particular family. There is no question that certain children will have the same malocclusion as one of their parents, and it is also a fact that certain children have the same malocclusion that their uncle or aunt may have. However, that does not prove the inheritance of the malocclusion, for it is very probable that the children have lived under the same environment and have been subject to the same pathological condition as have their parents. In the case of the royal family of Europe that has the peculiar mandible, one will probably find that that particular branch of the family has been subjected to rickets and a certain number of them have also had enlarged tonsils. If you have followed the press reports of that family you will often notice that some of them have been in some famous hospital for the treatment of throat lesion. The type of malocclusion which they possess has not been the result of inheritance, but the result of the acquired pathological conditions which has produced the same type of deformity in all of them.

Another hereditary factor which has been mentioned in the production of malocclusion is supernumerary teeth and missing teeth. At the present time so little is known of the direct cause of the supernumerary teeth, that it can not be stated positively that they are inherited in all instances. We know from a physiological standpoint supernumerary teeth are caused by the development of an extra tooth germ given from the epithelium cord, and from the study made, by Black several years ago, is shown that the teeth can be classified anatomically according to the position from which they originate from the epithelial cord. But even that does not explain the real reason for their development. Some men have claimed that supernumerary teeth are the result of atavism, which is the recurrence in an individual of organs and characters possessed by some of his ancestors. Therefore they claim that supernumerary teeth are an attempt upon the part of Nature to supply the individual with the same number of teeth which his ancestors formerly possessed. It is an accepted fact that man has originated from ancestors who possessed more incisors and premolars than man possesses normally at the present time. It is also a fact that the majority of supernumerary teeth are found in the region of the incisors and premolars. Very seldom do we find the supernumerary canines, and if we do find a tooth in the region of the canine it is probably a supernumerary from the incisors or premolar region. Following this rule then, supernumerary teeth in some instances may be the attempt of nature to supply the human family with a greater number of teeth than they now possess, which characteristic is probably inherited from ancestors years ago. However, there are no authentic cases which show the supernumerary teeth have been handed down from generation to generation without an interruption anywhere along the line. Missing teeth have also been considered as coming under the influence of inherited factors and possibly in some instances missing teeth are inherited. They are also considered as being the attempt of Nature to further reduce the number of teeth in man. and this is substantiated by the fact that the missing tooth is more

often a lateral incisor or a lower premolar. However, one objection to the theory of missing teeth being produced by the tendency of Nature to reduce the number of teeth in the dental apparatus is found in the fact that Nature does not seem to be positive as to which tooth she wishes man to lose. As I have stated the teeth most often missing are the lateral incisors and the premolar, and late investigation seems to indicate about ten per cent of the children of today have missing one or more teeth. Whether this estimate is too high or too low will probably be proved later by a collection of radiographs which are being collected by different men in different communities. In considering missing teeth it must be remembered that there are certain types of missing teeth that are purely congenital which are produced by the lack of development of the tooth germ without any cause being transmitted from the parent. We must also remember that missing teeth may be acquired which may be a local condition wherein the missing tooth is lost early by the extraction of the deciduous tooth, or where the tooth germ is broken up by a long continued fever or constitutional disturbances which may be present in certain diseases of childhood. Therefore it is unsafe to say that all cases of missing teeth are influenced by inheritance, for taking the law of average one would expect to find only one-third of them influenced by inheritance whatsoever. In closing the remarks in regard to inherited malocclusion, I will state that at the present time the inheritance of malocclusion is considered as a rather negative standpoint. A great many conditions which were supposed to be inherited have now been found to be the result of acquired conditions either locally or constitutionally which now can be understood if analyzed, and therefore the question of inheritance plays a very small part at the present time.

Of the congenital conditions which produce malocclusion there are a few which might be mentioned briefly. Harelip and cleft palate are congenital conditions which may arise in any individual and which seem to be influenced by environment and in some instances by inheritance. However, there is very little to prove the truth or substantiate the fact that cleft palate is directly transmittible. We know of a great many instances of children born from parents who have harelip or cleft palate and the children are perfectly normal. We also know of a great many children with harelip and cleft palate who have been born of perfectly normal parents. Owing to these facts creeping into the argument it is quite impossible to build a strong structure on the theory of inheritance in the production of harelip and cleft palate. If we were to examine a large number of such congenital conditions, we would find that out of a thousand people, regardless of where they were located, regardless of their race or conditions, there would be about the same number of cases of harelip and cleft palate, providing the people or parents were living under similar circumstances.

It has been observed that children who are born of mothers who are forced to do manual labor during pregnancy or are more or less underfed, are more apt to have harelips and cleft palates than the children of mothers who have had the proper food during pregnancy and who have not been compelled to tax their systems by the performance of active manual labor. It has also been proved that the first-born child is more apt to possess a harelip and cleft palate, which

may be influenced by the mother lacing tightly and wearing tight clothing to hide the pregnancy. This habit has the tendency to force the developing mandible between the parts of the maxillæ and thereby hold the maxillæ bud away from the frontal nasal bud with the result that the parts never become united. While we do not know as much about harelips and cleft palates as we should, we do know that it is a congenital proposition and has probably been produced by something in the life of the child which has interfered with the union of the parts and is not the result of inheritance except possibly in a small percentage of cases.

Another cause of malocclusion which we do not know enough about, is the abnormal frenum. This is the attachment of the upper and lower lip to the gum tissue at the median line. Either the upper or the lower frenum can be abnormal, but the abnormal condition is more prevalent in the upper arch than in the lower; however, I have seen the lower frenum abnormal when the upper was normal. Ordinarily the frenum stops at a point gingivally to the gingival gum tissue which would be about one-third of the distance of the length of the root from the gum. In certain individuals it will be found that the frenum extends in between the central incisors passing lingually to a point slightly anterior to the anterior palatal foramen. In these cases of abnormal frenum, the frenum is quite dense and contains a great amount of connective tissue greatly resembling other ligaments of the mouth. In these cases we find the frenum is so large that every time the lip moves, pressure is exerted on the mesial side of the central incisors and tends to separate them. The exact cause of the excessive development of the frenum is not positively understood, but in the majority of cases is probably congenital. In examining a number of young children before the eruption of any of the deciduous teeth, it will be found that the frenum is always extremely large as compared with the normal in the adult and is attached to the occlusal border of the gum tissue. In following the eruption of the deciduous teeth and the development of the alveolar process, it will be found that the frenum seems to diminish in size, and the alveolar process grows occlusally away from the attachment of the frenum. However, if the frenum should continue to exist and remain attached to the occlusal margin of the alveolar process, it will eventually separate the incisors, and therefore become an abnormal condition. The abnormal frenum seems to be the continuance of a point of attachment, which is present in the young child but which disappears or changes as the child grows older. I do not know that all abnormal frenums are congenital and have often seen some that appear to be acquired for there was no evidence of them prior to the eruption of the permanent teeth. However, it may be that in those cases, the frenum has always been present and was only noticed after the deciduous teeth were lost.

In taking up the study of acquired causes, we reach a group of conditions, some of which are thoroughly understood and some of which are not understood at all, and which are quite numerous. In considering acquired causes as well as the consideration of inherited and congenital causes, I wish to impress upon your minds that anything that causes malocclusions does so by disturbing one of six forces of occlusion. There are six forces or factors which are responsible for the teeth assuming and maintaining definite positions in the

dental arch. They are as follows: Cell metabolism, force of approximal contact, the force of the inclined plane, muscular pressure, harmony in the size of the arches, and atmospheric pressure. If all of these six factors are working normally and continue to remain normal during the life of the individual, the result will be a normal set of teeth. However, if any one of these factors becomes abnormal any time in the life of the individual, a malocclusion will be started; and if the abnormal force continues, the malocclusion will be progressive and will continue to become more marked until the teeth become locked in an abnormal position by some other force of occlusion asserting itself sufficiently to hold the teeth in the malposition. This means that every person, regardless of how old he may be, can develop a malocclusion any time in life if some of the forces of occlusion become wrong. In considering acquired causes of malocclusion, we may then say that all of them produce malocclusions by interfering with some of the forces of occlusion.

One of the acquired causes which I wish to mention is faulty nutrition, which may begin as a congenital condition in the faulty nutrition of the mother during pregnancy or which may begin as an acquired cause early in the life of the individual because of the lack of proper foods during early childhood. We have already stated that if mothers are underfed and overworked, harelips and cleft palates are apt to occur in their children, and in a great many of these cases one may find malocclusions making their appearance later in life.

As a result of faulty nutrition of the child, it has been shown through study made by Hellman that there is a greater tendency for malocclusion to develop in bottle-fed babies than in breast-fed babies. There is no doubt that the bottle-fed baby does not receive the proper nutrition because it is practically impossible to modify or produce artificial food which would be as suitable for the child as the mother's milk would be, provided the mother is healthy. One reason for the great tendency to malocclusion in bottle babies is caused by improper nutrition and improper use. By use, we mean that in order for the dental apparatus to develop properly, the mandible and the maxillæ from the time the child is born, as well as the muscles associated with them, must perform the proper function. In all children it may be observed that the mandible is quite small as compared to the rest of the face. The mandible is a bone of environment and will develop with proper use. If it does not have the proper use there will be a tendency for the mandible to remain underdeveloped and as a result of that the malocclusion will make its appearance later in life. With a babe who is nursing the breast during the act of nursing he bites and chews the nipple and necessarily exercises the muscles of mastication, the muscles of the lip, the muscles of respiration with the result that much stress is brought to bear upon the mandible and the maxillæ as well as the force on the nasal structures. If the child is a bottle-fed baby the bottle is placed in such a position that he obtains his nutrition without any special effort, and as a result the muscles of respiration and mastication do not receive their proper function, and therefore the mandible remains underdeveloped. The question of use is also a factor, which continues throughout the life of the child, or at least through the time of eruption and shedding of his deciduous teeth. The modern child is not edu-

cated to masticate his food, because the food, in most instances, is of such a type that it does not require mastication. Therefore we find that mastication is discouraged and as a result of that the mandible and the maxillæ are not properly developed and they do not grow sufficiently large to accommodate the permanent teeth even if the deciduous do succeed in getting in their proper position in the dental appartus. The question of mastication as a factor for developing the mandible has been recognized by Ferris, of New York, who has made a number of experiments along this line which are very interesting and which prove conclusively that active mastication is a great factor in the developing of the mandible and the maxillæ and can be produced by masticating exercises which he has been trying with some of his patients. The effect of use on the development of the mandible and maxillæ can be very easily shown by comparing the skulls of the race of the people who require mastication with the skulls of those people who do not require mastication. The skull of the man who was forced to masticate his food shows a well developed mandible and maxillæ, while the skull of the man whose food does not require mastication shows a much lighter alveolar process, a much less developed mandible and maxillæ, and in the majority of cases, the teeth have some type of malocclusion.

Under the head of acquired conditions, I also want to mention constitutional disturbances for there is a tendency on the part of some men to claim all malocclusions are caused by local conditions and developed from purely mechanical factors. However, there are some malocclusions which are the direct result of faulty cell metabolism which is produced by certain constitutional diseases. Of the constitutional diseases which produce malocclusions we have rickets and tuberculosis. These diseases are quite common and have played a part in the production of a great many cases of malocclusion, and have never been recognized as having anything to do with the case, and in some instances they have not even been recognized as being present in the patient at all.

Rickets, which we will consider first, is a disease of malnutrition characterized by faulty bone development. In fact the faulty bone development is so common in this constitutional disease that it has been called a disease of the bone. However, later investigations show that all of the tissues and organs are affected to a certain extent, and that the faulty bone development is only the result of the malnutrition. The disease has also been considered as a disease of childhood, but it has been shown that it may also occur in adults. It is particularly liable to occur in pregnant women and in nursing mothers. If present in nursing mothers, it is obvious that the effect on the nursing child would be anything but satisfactory. The general symptoms of the disease are many, but I will only mention those that are associated with the teeth. In young children, one of the first dental symptoms is the tardy eruption of the deciduous teeth. Some men have claimed that if the first deciduous tooth does not erupt in nine months, the child is probably rickety. Along with the tardy eruption of the teeth will be an abnormal tenderness of the gums which may be large and puffed, showing evidence of inflammation. After the eruption of the deciduous teeth, they will be lost early, that is, if the disease continues. It must be remembered that the child may be normal at the time of the eruption of the deciduous teeth and the

first set of teeth will appear at the normal time. After their eruption the child will become rickety and the deciduous teeth will be lost too early. In those children who are suffering with rickets, the roots of the deciduous teeth absorb without any apparent reason. However, there is a reason and that reason is undoubtedly the great need in certain tissue for salts, and that need is partly supplied by the early loss of the deciduous teeth. That the absorbed root of the deciduous tooth has nothing to do with the development of the permanent tooth is proved by the fact that in these cases of the early loss of the deciduous tooth it is followed by the tardy eruption of the permanent tooth. The early loss of a deciduous tooth for any reason will result in the production of malocclusion regardless of what causes the loss. If this early loss is complicated by the tardy eruption of the permanent tooth, we still have a greater chance for the malocclusion to occur. The late eruption of the permanent tooth is again caused by the faulty nutrition. Along with these conditions which we have mentioned in regard to the eruption of the teeth, we find a faulty development of the alveolar process and the bones of the mandible and the maxillæ. The process contains a large number of spaces which are filled with an imperfectly calcified material resembling cartilage. Instead of the gingival marginal ridges of the process being but a small edge of bone, the margin is greatly thickened and rounded. In examining the patient's mouth, one will be impressed with the thickness of the alveolar ridge. This thick ridge is not an evidence of strength, but is the result of imperfect calcification. Rickets may be a contributing factor to any type of malocclusion or it may be the primary cause. One of the conditions or deformities which is the direct result of rickets is a very narrow upper arch with thick alveolar ridges to the lingual of the teeth. The lower arch is often wide with the apex of the molar and premolar roots turned to the buccal making a very wide mandible. As the mandible is poorly developed, it is deformed as the result of muscular pressure. As force is brought to bear on the teeth in mastication and as the muscles of mastication pull on the weak and poorly developed mandible, the mandible is bent upward in the region of the attachment of the masseter and internal pterygoids, which has the ultimate result of making a straight mandible in the region of the angle between the ramus and the body. As a result of this, the chin becomes unduly prominent and presents the characteristic "under shot" mandible so commonly seen, and which has been attributed to inherited family traits, but which is the direct result of rickets.

It must also be remembered that rickets is not a disease limited to any particular class, but may be found in the richer classes as well as the poorer classes. It must also be remembered that rickets associated with other conditions may produce malocclusion or simply complicate the matter and make the condition much worse than it would be otherwise. One of the symptoms of rickets which must be observed is the tendency toward large thick congested gums, and thick alveolar ridges. The teeth are prone to move very easy and one must be careful in making a prognosis, for while there is no doubt but that the teeth can be moved, there also is no doubt but that they will move as rapidly to positions of malocclusion.

Another constitutional condition which produces malocclusion is tuberculosis, and which acts directly the opposite of rickets; namely, the child who is tubercular will cut the teeth early, the deciduous teeth will be retained too long, and the permanent teeth will erupt practically on time. The principal malocclusion which will be caused by tuberculosis is a diverting of the permanent teeth as a result of the prolonged retention of the deciduous teeth. As to the seriousness of the malocclusion as produced by the constitutional diseases mentioned, I will only say that rickets produces much more unfavorable conditions than tuberculosis.

Another factor which enters into the discussion of a large number of malocclusions is what has been termed disuse. By disuse is meant the lack of use of the teeth as organs of mastication during the time the child is growing, and during the time the teeth should receive vigorous usage. It is a well known fact that any organ to be developed must receive the proper use, for use produces the proper circulation of blood in the parts as a result of which the parts develop. The deciduous teeth may be said to have two important functions. The first one is to act as organs of mastication during the early life of the individual, the second is to act as stimulating factors in the production of growth in the bone in order that the permanent teeth may have sufficient space when they erupt in the dental arch. If the deciduous teeth are not used as they should be used the permanent teeth will not erupt in their proper position owing to the fact that the bony structures supporting them are not developed sufficiently large to accommodate them. Of all the factors that have tended to produce malocclusion in the civilized man, I will say that the disuse of teeth probably plays as much of a part as any of the others. In other words, if every child were compelled to use his deciduous teeth in the manner which Nature designed them to be used there would be a far less number of underdeveloped arches than is found at the present time. As a result of this prevailing malocclusion in the modern child one may say that malocclusion is almost a disease of civilization—not as a result of civilization, but as a result of the environment under which civilized people live. In other words, if the civilized child were compelled to use his teeth in the manner for which they were designed, he would be no more liable to malocclusion than the savage child who is compelled to use his teeth for the purpose for which Nature gave them to him.

The effect of mouth breathing as a factor in the production of malocclusion has long been recognized by the dental profession and there is no question but that long continued mouth breathing will produce deformities of the dental apparatus, consisting of a narrow upper arch, protruding upper anterior teeth and an underdeveloped mandible with a receding chin. The principal cause of mouth breathing in children is the hypertrophied lymphoid tissue located in the nasopharynx, which is commonly termed adenoids. This mass of lymphoid tissue has always been more or less of a disputed organ as regards utility and function in the growth of the individual. Some men have claimed that the adenoid tissue of the nasopharynx plays a very important part in the growth of the child, acting somewhat in the nature of the ductless glands, while others seem to think it has no particular function and act accordingly. As far as my

observations go I have never observed any evil effects in children who have had their adenoids and tonsils removed in early life. Some men have claimed that the removal of the tonsils will produce a lack of development in the dental apparatus, but I have not seen this occur. In fact, some of the worst developed dental apparatus I have ever seen have been in children who had normal adenoids and tonsils. We do know that hypertrophied lymphoid tissue produces nasal obstruction and resulting malocclusion, but we do not know that its removal has any detrimental effect on the dental apparatus. Therefore, I am inclined to believe that in those children where the lymphoid tissue has hypertrophied and the tonsils are inflamed, I would rather have the tissue removed and take a chance of abnormal conditions being produced by their removal, than to have them remain when it is absolutely certain that a pathologic condition is no help to the child, and it is almost certain to produce some type of malocclusion.

The diseases of the ductless glands have attracted considerable attention of late and there seems to be no question but that the ductless glands have certain influences on development, and that pathological disturbances originating in them produce certain types of malocclusion. We very often observe abnormal growths in the jaws at various regions. They seem to occur without any definite reason and are probably the result of some disturbance of the ductless gland that we do not know enough about at the present time to decide on any real scientific and specific treatment. I have seen cases where the bite would begin to open in the incisor region without any apparent reason, also cases where the occlusion seemed to be normal and all of a sudden, without any particular reason, the mandible would begin to develop before the loss of the deciduous teeth and produce a malocclusion the treatment of which seems very hopeless at the time being, because the exact etiology of the condition is not known. Therefore one of the prime needs of orthodontia today is a more complete study of etiological factors because solving etiological factors in any pathological condition is a great step towards the satisfactory treatment of the trouble.

In closing, then, let me make a plea for more careful observation of the things that may cause malocclusion. For real science is based upon the fact that we know first what causes the condition, and after we know the causative factor, the treatment becomes much more easily understood.

FACIAL IMPRESSIONS AND CASTS

By Oren A. Oliver, D.D.S., Covington, Va.

Part III.—The Full Facial Cast with Insert.

THIS phase of the discussion of the work on the treatment of facial casts and impressions is merely an outline of the construction of the front facial cast plus the insert, which, by the way, is a very valuable addition. The insert is a plaster replica of the teeth when in a normal position, and when this representation of the teeth is properly molded and correctly placed within a plaster cast of the full facial view, it shows the outside of the face of the patient, exposes to view the teeth normally closed, and gives the relative position of the teeth and jaws with all defects in evidence.

The construction of this cast is far more intricate than that of either of the foregoing impressions; in fact, this construction is practically the same as that of the front facial cast much elaborated by the addition of the insert. The first thing to be done is to make a full facial cast, beginning with the top at the coronal suture, taking in the eyes and ears, and at the bottom, including the front part of the neck. In the construction of as large a cast as this, it is necessary for the patient to lie on a table, for if a chair were used, the slope would cause the plaster to run down the neck and it would be difficult for the operator to apply plaster to cover the ears. Small rubber tubes are used to facilitate the breathing during the operation, as usual, vaseline covers the face before the plaster is put on, and the work is the same as in the front facial cast with the addition of some few details.

Since the ears are to be included in the impression, cotton must be placed in them to prevent falling plaster from injuring the drums, and a small cotton roll should also be placed behind the ear to keep the weight of the coating from pressing it against the head, as well as to aid in the removal of the impression. When the pasteboard frame is used, it must be large enough to fit around the head well back of the hair line, back of the ears, and down the sides of the neck. The plaster is easier to manage if the frame is bent rather in the form of a scoop to keep the wet coating from escaping its bounds and going down the neck. An assistant to hold the pasteboard in place will not be amiss and will enable a better handling of materials. When the plaster has been put on, hardened, and removed, the impression is then painted with two coats of shellac and one of sandarac. The impression is then carefully laid away for the cast is not poured until the insert is made and fastened in position within the full facial impression, when the impression as a whole is filled with plaster.

The next thing to be done is to make the insert for the cast. The preliminary arrangements as to breathing apparatus, etc., are the same as in the full facial cast, but in this case no portion of the face need be included excepting the center forehead, nose, mouth, and chin. The patient should close the mouth and teeth normally and this natural position must be maintained throughout the whole procedure. With the forefinger of the left hand the operator should separate the lips and hold them away from the teeth far enough that a soft

plaster mix may be worked well between the lips and the teeth. Care should be taken to cover thoroughly all of the teeth as far back as they extend, and even a little farther, finishing one side at a time, and then coating the front well up under the lips. After the interior of the mouth in front of the teeth is filled with plaster, work is begun on the exterior and the features to be included in the impression are covered (Fig. 11).

When the plaster has set, the outer part of the model may be gradually loosened and removed by breaking it away at the lips. That portion of the impression which is within the mouth can not be taken out in one piece, but will usually divide into two or three parts. These parts of the impression may be reassembled by the use of a small amount of sticky wax. A varnish, first of shellac and then of sandarac, when the blemishes have been removed, produce the impression of the insert ready to be poured (Fig. 12).

Before the cast is poured, a small cotton roll is placed between the teeth and the outer wall of the impression to prevent the plaster from filling the intervening space (Fig. 13). When the pouring has been completed and the plaster walls cut apart in the usual manner, the insert proper is finished. There is no necessity for this whole model to be used in obtaining a plaster reproduction of the teeth only, but in order to place the insert properly in the full facial cast, some chief points are needed. Therefore, it is a good plan to cut away the exterior features of the insert with the exception of the tip of the nose, the central part of the forehead, and the projection of the chin, leaving only the teeth with these points as guide posts to location (Fig. 14).

When the entire cast with insert is completed, the exterior of the mouth is shown on the one side of the face, while on the other, a piece of plaster has been cut out showing the teeth as they appear inside the mouth. A removable wax block molded to follow the contour of the mouth on the outside, is fitted into this open space, so that when in place, the whole outside of the mouth is seen, and when removed, the teeth are exposed on that side. It is a delicate task to fit the wax perfectly to conform to the imprint of the teeth, and yet on the outside, to take the shape of the lips. To fit this block, the insert is temporarily placed in position in the mold of the face as a whole. With a pencil, marks are made to indicate where the projections of nose, forehead, and chin fit into the corresponding depressions in the unpoured facial impression. Then, when some wax is applied to the side of the insert to be used, the block is gradually built up. By following the pencil marks from time to time, the plaster insert with the wax addition is put in place, and with many careful trials the wax will soon fit into its place. The application of a little heat to the wax will give it the right constituency making it malleable enough that when the insert is in position, the wax may be pressed firmly between the mold of teeth and lips giving it the impression of both (Fig. 15).

The insert must be held in its exact position while the mold is being poured, so for this purpose a special device is made. This retainer consists chiefly of a curved piece of steel about a quarter of an inch in diameter and twenty-six inches in length, a crossbar of steel about eleven inches by three-quarters by one-half inch, and a set screw about eight inches long and one-half inch or less in diameter. The ends of the round piece of steel are cut in threads for five or six

Fig. 11.

Fig. 12.

Fig. 13

inches, and these ends pass through slots one and three-quarters inches in length cut in each end of the crossbar. In the center of this bar is passed the set screw (Fig. 16).

When the apparatus is complete, the curved piece of steel is placed around

Fig. 14

Fig. 15

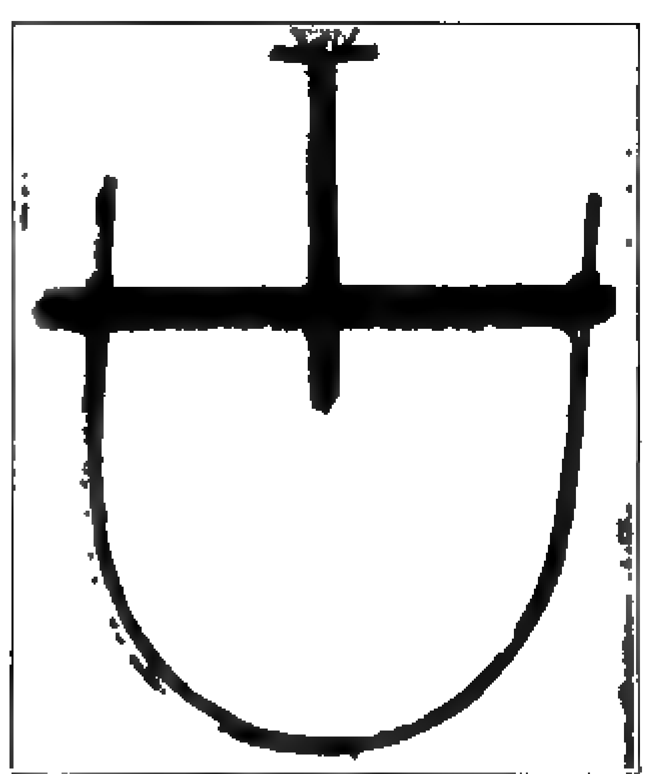


Fig. 16.

the center of the impression and bent to conform to the outer surface. Notches are cut in the plaster on either side of the impression about the height of the ear, and one in front about the location of the mouth, and on these rest the curved piece of the retainer. The insert is carefully placed inside the outer

Fig. 17

Fig. 18.

Fig. 19.

Fig. 20.

Fig. 21.

impression and the wax block takes its correct position. The placing of these is extremely important, as their location now is permanent. A cork is inserted in the back of the insert in order that the thumb screw may be fastened securely All is in readiness now for the adjustment of the steel device.

The curved piece of steel rests in the notches, and when the threaded ends pass through the crossbar, they are held tight with nuts and the thumb screw is screwed into the cork until there is no danger of the insert slipping from position (Fig. 17).

A thin mix of plaster is poured into the mold and a soft brush is used to work well down into crevices. The cast with the insert is so heavy that there is no easy way to manage it without the introduction of some outside instrument, therefore, after the surface is entirely covered with plaster, a round piece of wood or iron is fitted into the back of the cast about opposite the ears (Fig. 18). This serves as the necessary handle for the convenience of the operator. When the bar is in position, a second mix of plaster is poured in, and when it has hardened the impression is marked off in sections (Fig. 4, Part I) and carefully separated. The separation accomplished, the finished cast appears with the wax insert in place (Fig. 19). This wax block is easily removed by simply working it loose, and the complete full facial cast with the insert remains (Figs. 20 and 21).

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

JAMES DAVID McCOY, D.D.S., EDITOR,
LOS ANGELES, CALIF.

CONCERNING BRIDGES

BY GRAY C. BRIGGS, M.D., ST. LOUIS.

A MAN consults a dentist. He has a bridge which is sensitive to pressure. There is no sharp or constant pain but rather a tenderness that is manifested on mastication. To treat this properly the dentist must have some accurate knowledge as to the causative element. He considers the possibilities. It might be that the trouble comes:

1st. From a tooth forming one of the abutments. It might be caried, or abscessed. There might be a granuloma or a pulp stone.

Fig. 1.—Observe in this case the ravages of pyorrhea. Note how the alveolus is absorbed above the crown on the molar and see the almost complete absence of attachment between the roots of the tooth forming the posterior abutment and the bone.

2nd. From an irritation produced by the bridge itself. It might be impinging on the gingiva; there might be a faulty adaptation of the band; an excess of cement might have been used which forced down under the crown and, hardened, is cutting the gum.

3rd. From some pathology of the alveolus. An unerupted tooth, an impaction, abscess formation, cyst, or perhaps an odontoma is forming.

4th. From mechanical errors in technic. The span may be of too great

Fig. 2.—Les enfants terribles: These two small root fragments, shown under the bridge, are the remains of a second molar incompletely extracted prior to the time the bridge work was done. Note the infection and absorption, and that the posterior fragment is being thrown out, impinging on the bridge.

Fig. 3.

Fig. 4.

Fig. 3.—A case from the practice of Dr. Charles Grosby. No trouble was found in the immediate region of the bridge. Observe in the porcelain crowned tooth just in front of the bridge how the post perforates the side of the tooth and has caused absorption. This was clearly a case of reflex irritation.

Fig. 4.—Notice the caries and absorption of alveolus between the two molars. Also that the canal of the bicuspid is unfilled, though no trouble has resulted therefrom.

Fig. 5.

Fig. 6.

Fig. 5.—Observe the gutta percha point above the apex of the central. A discharging sinus which had existed over a period of years was fed from the alveolus between the lateral and the bicuspid. This absorption area is shown on the roentgenogram and is of considerable proportions.

Fig. 6.—In this case the irritation was caused by a bit of hardened cement clearly shown mesial to the second molar. In putting the crown on the abutment this excess cement was not removed. A gingivitis and resulting sensitiveness was produced.

length. A cantilever bridge of excessive leverage may have loosened the supporting tooth.

5th. From reflex irritation; the tooth causing the disturbance may be wholly dissociated from the bridge.

There are other causes, too. Occasionally cases wierd and wonderful appear, cases which would never under any circumstances be properly diagnosed without the agency of the roentgen ray. There are cases too which wander with

Fig. 7.—This case from the practice of Dr. Bartlett and Dr. Loeb we were unable to diagnose. We reported that a shadow consistent in size and shape with that which a tooth might make was observed under the bridge. It evidenced no root canals, however, and had no space for the peridental membrane. We asked to be advised if the pathology was ever ascertained. A few days later Dr. Loeb stated to the writer that the case had been operated and the shadow in the roentgenogram was produced by a calcium formation in the socket of the first molar. Since the time this film was made two other identical cases have been examined.

growing dispirit and distrust from dentist to dentist, to physician, and back again to dentist without relief, not because any inability to treat the case exists but because no accurate conception of the causative element has ever been obtained.

I have selected from my files a few of these bridge cases to show how simple the diagnosis sometimes becomes when the case is subjected to a roentgen examination.

THE X-RAY PICTURE GALLERY

By B. Frank Gray, D.D.S., Colorado Springs, Colo.

When visiting one of our large cities a year ago, I was surprised to learn that many members of the dental profession were depending on men outside the profession to diagnose for them, or aid them in diagnosing, the pathology of the teeth and their investing structures.

Only fully qualified and regularly licensed dentists and physicians should be allowed to render radiographic service.

The x-ray, with our present understanding of its nature and application, granting all its advantages, is a dangerous agent. It is capable of producing injuries of a grave character, both to patient and operator. One need not go out of his own immediate community to verify the truth of this statement. Certainly, on the ground of the best interests of the public, it should not be possible for patients to secure services of this character at the hands of uneducated, unqualified and unlicensed persons.

The value of radiographic findings depends upon the clinical evidence attaching to a given case, upon a knowledge of the anatomy and pathology of the parts pictured, upon a proper interpretation of the films or plates, upon the angle at which the picture is made (known only to the operator), upon the intensity of the ray, and upon numerous other considerations. Thus it may be seen, the work being done in many of these x-ray picture galleries is purely a mechanical procedure, and the opinions of the operator are without value to the dentist.

These men actually solicit the x-ray work from dentists at a stipulated price per month, agreeing to do all work sent them. I have noted "quotations" as low as $7.50 a month for such an arrangement! What an opinion these men must have of the dental profession! Unless some of its members have a care, they may justify the opinion in which they are evidently held in certain quarters.

Again, all too frequently, films are loosely mounted on cards,—four, six or a dozen to a card. Should they become transposed in their positions, as is so perfectly possible, it is not difficult to imagine the serious results that may follow. All films passing out of an x-ray operator's hands, should be accurately labeled, and firmly enclosed (together with the labels) between glass plates, where they can not be tampered with.

Those professional men who patronize these mushroom x-ray establishments, must place a very low estimate upon the requirements of high class radiographic services, and upon the dignity of their own profession. In some quarters the roentgen ray is in disrepute, and I have outlined in this brief paper the chief reason for it. The time is opportune for a "Right about—Face!" in this matter, and I hope members of the dental profession may awaken to their responsibility.

As a matter of fact, the use of the roentgen ray in the professions of medicine and dentistry, should be *legally defined* as actually constituting the practice of medicine or the practice of dentistry, as the degree held by the operator may determine. Then, and not until then, will this important work receive its rightful status.

"Stop—Look—Listen!"

SINCE the message was sent broadcast by a few investigators in the field of root pathology that apical foci of infection were responsible for the onset of chronic infections in remote areas of the body, *thousands of teeth have been uselessly sacrificed.* It has been the experience of a number of practitioners, the writer included, that the conclusions of enthusiasts in the field are not *always* warranted by the clinical results secured in many chronic cases following the removal of presumably infected roots. Case after case could be summoned in support of the contention that root pathology in its bearing upon the development of systemic lesions is as yet in semi-obscurity and that the so-called focus of infection upon or adjacent to a tooth root is not to be construed in every instance as the only source of a generalized disturbance. This conclusion is reached after having observed a weighty number of cases in which no appreciable improvement could be observed after months of patient waiting. We have seen patients regain their health after the extraction of infected roots or the surgical

treatment of their apices; we have also seen patients from whose mouths as many as ten teeth have been extracted in the hope of eliminating a deep-seated infection with no other result than the loss of their masticatory organs.

We believe that to a large extent these negative results can be traced to a misconception of the pathologic significance of certain shadows in radiographic films or plates and to the unwarranted advice so liberally dispensed that tooth roots presenting what is erroneously interpreted as an active focus of infection should be at once sacrificed to the forceps. Clinical results are flatly contradicting the assumption that every shadow upon the root of a tooth in a radiograph is a focus of infection, and laboratory experiments in those same cases are likewise giving negative results. A shadow on the apex of a root may indicate one of several things, herein including the filling up of the cancellated spaces in the alveolar bone by a proliferation of the soft tissue which normally fills the cancellated spaces. If as the result of an involvement of the alveolar bone, following an infection emanating from the pulp or pericemental membrane, some of the cancellated spaces are destroyed, as occurs in osteomyelitis, following, or simultaneous with, an inflammatory proliferation of the myelitic substance (the substance contained in the cancellated spaces), a dark shadow will be brought out upon the radiograph even though all bacterial elements be absent, i. e., the density of the area has been materially decreased by the filling in of the enlarged cancellated spaces by soft tissues. Again, in the case of a chronic infection of the peridental membrane which has spread to the alveolar process, causing the loss of osseous substance with perhaps practically no attempt at obliteration of the space by organic tissue, a dark shadow will be shown on the plate even after complete eradication of the infection.

Another misconception of root pathology is in the tendency to regard dark shadows upon radiographs as evidence of the presence of granulomata; viz., tumors or enlargements of the peridental membrane made up of a large number of embryonic connective tissues containing within its meshes epithelial elements or again made up entirely of connective tissue. The number of teeth which we have examined after extraction which upon previous radiographic examination showed fairly large blackened areas adjacent to the apical region, leads us to the conclusion that the presence of granulomata is the exception rather than the rule.

A "Stop—Look—Listen" sign is appearing in the dental horizon and the leaden forceps of the Temple of Apollo at Delphi is again casting its shadow. Valuable as unquestionably the x-ray has become in the hands of the radiographer-pathologist, equally as dangerous it is becoming in the absence of a complete system of diagnosis which should include the history of the case; the clinical examination, laboratory findings and the x-ray. Complete reliance on the radiograph is, at the present time at least, not warranted as the sole means of diagnosis. *It is not the x-ray machine alone that the dental office needs; as much as it does the x-ray machine plus correct pathologic interpretation of lesions of the teeth and adjacent structures.—Editorial by Julio Endelman, in the "Pacific Dental Gazette."*

The International Journal of Orthodontia

.PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 801-807 Metropolitan Bldg., St. Louis, Mo.

Foreign Depots—*Great Britain*—Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

Subscription Rates—Single Copies, 30 cents. To anywhere in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $3.00 per year in advance. Under foreign postage, $3.40. English price: 15/ per annum, 1/6 per number. Volume begins with January and ends with December of each year.

Remittances—Remittances for subscriptions should be made by check, draft, postoffice or express money order, or registered letter, payable to the publishers, The C. V. Mosby Company.

Contributions—The editor will be pleased to consider the publication of original communications of merit on orthodontic and allied subjects, which must be contributed solely to this journal.

Opinions—Neither the editor nor the publisher hold themselves responsible for the opinions of contributors, nor are they responsible for other than editorial statements.

Reprints—Since it is not desirable to hold type standing longer than absolutely necessary, all requests for reprints should be made at time of submitting manuscript for publication. Rate card will be sent with galley proof.

Communications—Contributed articles, illustrations, letters, books for review, and all other matter pertaining to the editorial department should be addressed to the Editor, Doctor Martin Dewey, 25 East Washington Street, Chicago, Ill. All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 801-807 Metropolitan Building, St. Louis, Mo.

Illustrations—Such halftones and zinc etchings as in the judgment of the editor are necessary to illustrate articles will be furnished when photographs or drawings are supplied by the authors of said articles.

Advertisements—Objectionable advertisements will not be accepted for publication in this journal. Forms close first of month preceding date of issue. Advertising rates and sizes on application.

Change of Address—The publishers should be advised of change of subscriber's address about fifteen days before date of issue, with both new and old addresses given.

Nonreceipt of Copies—Complaints for nonreceipt of copies or requests for extra numbers must be received on or before the fifteenth of the month of publication; otherwise the supply is apt to be exhausted.

Entered at the Post Office at St. Louis, Mo., as Second-Class Matter

EDITORIALS

Dentists in the Army

AS the United States is preparing to do its part in the great world conflict in order that democratic government may exist, and that principle founded upon personal freedom will not be brushed aside by military rule, we are confronted with the problem as to what is the duty of the dentist in the present world conflict.

About a year ago there was organized the Preparedness League of American Dentists, the object of which was, that each member of the league should prepare the mouth of one recruit in such a manner that he would be able to perform military service. A large number of men joined the Preparedness League of American Dentists because the initiation fee was only one dollar, and they considered such a move a patriotic measure regardless of whether they were called upon to do anything or not. Up to the present time, a large per-

centage of that membership have performed their service by preparing the mouth of one recruit in such a manner so that he can pass military examination, but there are also a large number who have not done anything.

It is hoped that every man in the dental profession will do his part in preparing the teeth of one recruit in such a manner that he will be able to serve his country. It is not expected that every dentist will be able to perform military service, because there are a large number of men who are better fitted for that purpose than the dental profession. However, it must be remembered that a number of dentists will be required in the army, and the number required will be much larger than that provided for by army regulations.

At the present time, one dentist is allotted to about every one thousand soldiers. Everyone knows that in time of peace it is impossible for one dentist to keep one thousand mouths in order, giving them the proper dental and prophylactic treatment which they should receive. It is a fact that there has been provided a Reserve Dental Corps to which dentists can be admitted by passing a physical and professional examination before a board composed of two army dental men and one medical man, proving their fitness for this service. They are then appointed for five years subject to call upon invasion or threatened invasion of the country by an enemy or upon a declaration of war.

The men of the Reserve Dental Corps have the rank of first lieutenant with a salary of $2,000 a year when in service. They are allowed all of the allotments going with their rank while engaged in service; and if injured in service, receive the same pensions as other men of their rank. We are informed that there are a large number of men who have applied for admission to the Reserve Dental Corps which is as it should be. We have also been informed of the large number who have applied for admission into the Reserve Corps, some have attempted to get a rank higher than lieutenant, and we have been informed that even some have made applications for the rank of major without having had any previous military service. Of course, such things in the eyes of military men make the dental profession appear ridiculous, and it is hoped that those who enter the Dental Reserve Corps will remember that there are a great many men who are better fitted for military service than is the dentist.

In other words, the dentist has a very important service to perform, but he should be satisfied in performing that service. We have also learned that a large number of men who were applying for admission to the Dental Reserve Corps hope or are of the opinion that they will be allowed or permitted to do a large amount of oral surgery and not be called upon to perform ordinary dental operations. As a matter of fact, the men which the army and navy need today are men who will do ordinary dental work and prepare the mouths of army and navy recruits in such a manner that they will be able to perform the proper military service.

There is a large amount of "preparedness" work needed which can be performed by dentists, and someone must do the ordinary dental work. Every dentist who enters the Dental Reserve Corps should not expect to do oral surgery because it is our hope that there will be very little demand for oral surgery which always comes after the conflict. The dentist's work is necessarily one of

preparedness, and must be rendered before the actual army and navy engagements take place. Of course, upon the field of battle, in the line hospitals and base hospitals, someone will have to do oral surgery, and at that time it is very probable that the dentist with the first contingent will be the one who will get the major amount of oral surgery.

However, it must be remembered that the work of the oral surgeon will be comparatively small compared to the work of the general dentist, and we are therefore making the plea in the name of patriotism that the dental profession do their part as dentists because they will have as important a part in winning this battle by doing their work well along dental lines and oral prophylactic lines, as will any other group of men. We believe, therefore, that the dentists who enter the army and navy should be dentists first, and oral surgeons afterwards.

In regard to official rating and standing in the army and navy, if they are qualified, do their work well, perform the tasks which are before them today, tomorrow, and the next day, the best they possibly can, there is no question but that they will be in line for promotion as well as any other branch of men. It must be remembered in raising a large army and navy, as the nation hopes to do, each group of men will be compelled to do the work allotted to it. We hope the dental profession will not make itself appear ridiculous by trying to assume responsibilities or do a line of work which is entirely beyond it, and not be content to do that which it is supposed and qualified to do. The importance of the dentist in the army can not be overestimated, but fulfilling that importance rests with the dentist first, last, and always.

We have observed in our conversations with various men who are contemplating joining the Dental Reserve Corps that they seem to be ashamed to admit that they are dentists, and all of them are trying to become oral surgeons. The man who is not ashamed to fight for his country and his flag should also not be ashamed of his profession, and especially when the profession is one of the most important and one of the most useful in the army and navy today.

The National Dental Journal and the State Dental Journals

AT various times we have mentioned the fact that the crying need of the dental profession is independent journalism, or journals which are not controlled by dental supply houses, which are published for the advancement of dental science from a scientific standpoint, and not for the advancement of the sale of commercial articles.

If there is any one thing that the dental profession needs more than any other to advance it and to bring it up to the standard which it should occupy, to give it the dignity of a profession which we have always hoped it would have, it is the establishment of independent dental journals. The foundation of the *Journal of the National Dental Association* was a step in the right direction, and our only regret is that it has received so little recognition and support from the dental profession. We wonder if a greater effort could not be put forth, and greater good accomplished, if there would be united efforts towards the foundation and support of independent dental journalism. With the reorganization of

the National Dental Association the various state societies were made component parts of the Association in order that it would have a larger membership so it would be possible with the state membership to establish and maintain a national dental journal.

Now that most of the dental societies have been made component parts of the National Dental Association, we believe that each state society should work with the one single purpose of advancing the Association and consequently advancing the *Journal of the National Dental Association.* We find that the various state dental societies have adopted different methods in the publication of their proceedings. A number of the state societies still follow the plan of having their proceedings published by some trade journal, while a few state societies publish their proceedings in a monthly journal, and others have the same published in bulletins. We believe that the publication in state dental journals, whether published monthly or in the nature of a bulletin which contains only the proceedings of the society, is a step in the right direction. But we also believe that at the present time greater good might be accomplished, the National Dental Association be made a stronger organization, and its journal be made a more powerful organ, if each state association would lend its support to the Journal.

For instance, in some states in addition to the dues which are paid to the state society and into the National Dental Association, there is a certain proportion of the dues which goes to the support of the state journal or the bulletin. If the amount of money which is paid by the state societies for the publication of state dental journals and state bulletins were turned over to the *Journal of the National Dental Association,* and the proceedings of the state societies published in this Journal, the papers from the state dental societies would have a wider circulation, and the Journal would be a more powerful organ. If the state societies are component parts of the National Dental Association, why should they not be component parts in fact as well as name? Why should not the proceedings of state dental societies be published as a part of the Journal, and this Journal be published monthly, or better, every week, as the *Journal of the American Medical Association* is published?

If there is not sufficient money in the treasury of the National Dental Association to make its journal the official organ of all the component state societies, then some provision should be made for raising more money for its supprt. In the case of states that have special journal funds, or societies which contribute a certain amount for the publication of their proceedings in an independent dental journal, this sum of money can be diverted to the *Journal of the National Dental Association* which can publish the proceedings of those societies even if it can not publish the proceedings of all the other states. If it were possible for some few states to make the move towards contributing a sum of money to the journal or to publish their proceedings in National Journal, it would only be a short time until the various other state societies would follow the lead and the National Dental Journal would be a national journal in fact as well as in name.

One objection which has been raised to the publication of independent dental journals, state journals, or state bulletins is the fact that the proceedings of those societies are not given a wide circulation, and papers which are valuable are

very soon lost or are brought to the attention of only a few readers. Therefore, if all of the state societies would publish their papers in the Journal they would all have an equally wide circulation, they would all be in a compact form which could very easily be preserved and papers which are worth something would be a matter of record.

We do not forget the fact that a great many papers which are read before state dental societies are simply a repetition of something that has been worked out before. It would therefore be necessary for the journal to be presided over by an editor who had sufficient knowledge of dental literature, and sufficient knowledge of important subjects, to enable him to edit the articles from the state dental societies and eliminate such as were not worthy of publication. This would alleviate the necessity of publishing matter over and over again, which would result unless the editor of the journal had sufficient authority to edit the proceedings of the various state societies.

We believe, then, that the greatest good can be accomplished by the *Journal of the National Dental Association* being made a national dental journal in fact as well as name, and that this can be best accomplished by the united efforts of all the component societies working for the support of the journal and deverting such money as they now devote to the publication of state journals, bulletins, or trade journals for the publication of their proceedings, into the treasury of the *Journal of the National Dental Association* and so make the Journal a more powerful organ. The Journal should be presided over by an editor-in-chief, whose sole purpose should be the editing of the Journal, or by an editorial board which will have sufficient authority to edit all the articles that come for publication so that there will be published only articles that have real merit. Other articles, which are simply a repetition of the subject, will not be published, and if this plan is followed out, we will find that the National Dental Association and the dental profession as a whole will have a journal of which they will be proud.

The Pathmaker in Dentistry and Medicine

"I will not follow where the path may lead, but I will go where there is no path, and I will leave a trail."

—*Strode.*

THE great need of the dental and the medical professions today is the pathmaker; the man who will walk through the untrodden field and leave a trail. Original thinking and doing is hard work, and man inherently is a lazy animal. Most men prefer to loiter along the beaten highway, content to pick here and there a berry or a flower that has been overlooked by the travelers who have passed on before, rather than take chart and compass, explore the trackless wild; make a new path, derive all the pleasure and profit that belongs to the pioneer, and leave a trail.

Fill a root canal like a thousand others have been filled, crown or inlay just as your predecessor has done countless times before you, correct a de-

formity just as your textbooks tell you, classify a pathological condition just as someone else classified it for you, and go on your way content to eat, sleep, and reproduce your kind. Moles have no need for eyes because they live in eternal darkness. Many professional men, so far as seeing things and adding to the sum total of human knowledge is concerned, are closely akin to the mole.

The curse of civilization is the man with rules. He learns a rule for some special phase of technic from a teacher or a textbook, and he follows that rule to his professional grave. Afraid to break away from precedent, he follows like a beast to the shambles. It seems to be a difficult matter for dentists and physicians to realize that every case that comes under their care is one that presents problems differing from that of other individuals and calling for thought and careful observation. Teeth have been filled for generations, and the operator has prided himself that they have been correctly filled, until the x-ray revealed that the work was that of a bungler. Crowns have been put on that appeared to be well done. The technic adopted was the same that the textbook or the instructor advised, but in a short time the patient upon whom the rule of thumb was practiced developed an arthritis, a neuritis, or an endocarditis. By good chance the patient falls this time into the hands of a man who does a little thinking on his own account. His textbook may never have told him that teeth could be badly crowned. His instructor may never have brought to his attention the fact that tooth infection can be the cause of systemic disease; but, because this man has been trained to think, because this man follows no path but makes his own and leaves a trail, he goes over his patient from head to toe. He sees the evidence of focal infection, and as a result of his efforts the mistakes of the man who crowned the tooth strictly according to the textbook, are brought to light.

Much of this dearth of original thinking on the part of the dentist can be laid squarely at the doors of the dental college and the dental journal. Few teachers in dental schools have as their chief objective the implantation of suggestion in the minds of their students that will aid the students to think for themselves. In this there is another evidence of the blind trying to lead the blind. Most teachers in dental schools live by rule, work by rule, and teach by rule. One of the sad features connected with dental education today is the fact that so many teachers have nothing more than a grammar school education. Their vision is restricted to the mechanical side of their work, and their sole ambition seems to be to educate dentists that may be good mechanics, but very poor scientists, and with no power of original thought. Much of the blame for the dearth of original thinking and path-finding among the dentists can be laid justly to the dental journals. Controlled by the manufacturer and the jobber in dental supplies, the journals of this country have done little or nothing to stimulate research work and individuality of thought among the dentists. Human action, without exception, is dominated and controlled by stimulation. Unless you stimulate there is no life. A scientific journal exists by right of its ability to stimulate scientific thought and to widely disseminate information. When it fails to do this, it has forfeited its right to exist. A scientific journal can do more to stimulate original work among its readers through its editorial pages than in any other way, but the dental journals of America seem to be

unmindful of this obligation. Go through the file of any of them for five or ten years back, and you will see little that would stimulate a dentist to make his own path in his science and leave a trail.

But let it be said that at the present time a change from the old order of things is in evidence. Dental schools are awakening; the unfit among them are doomed, and, like the aborigines, will soon live only in memory and in song. Universities with trained, educated teachers will take their places, and these will give birth to a race of dentists that will be an honor to the science of dentistry, and a blessing to mankind; and the dental journals, too, will evolute, and the unfit will join the discarded colleges upon the scrap heap. Independent journals will take the place of the trade controlled and commercially dominated organs that now circulate widely through the graces of pound postage rates. Then the worker in dentistry will follow no path; each will make his own path, and will leave a trail.

Program of the Seventeenth Annual Meeting of the American Society of Orthodontists

Elms Hotel, Excelsior Springs, Mo., September 5 to 8, 1917

I. President's Address, Dr. M. N. Federspiel, Milwaukee; Report of the Board of Censors.

II. Anatomy and Physiology.—(1) The Evolution of the Human Teeth, Prof. H. F. Osborn, New York City.

III. Medicine and Therapeutics.—(1) Constitutional Diseases in Infancy and Dentition, Dr. Gustav Lippmann, St. Louis; (2) The Oral Efficiency of Therapeutic Preparations, Prof. Hermann Prinz, Philadelphia; (3) The Scientific Feeding of Growing Children, Mr. A. W. McCann, New York City.

IV. Surgery.—(1) The Surgical Treatment of Extreme Malformations Involving the Jaws, Tongue, etc., Dr. Gordon New, Rochester, Minn.

V. Radiography and Photography.—(1) Practical Radiography for the Orthodontist, Dr. E. H. Skinner, Kansas City; (2) Orthophotography and Multiview Projections, Mr. Rudolph L. Hanau, Brooklyn.

VI. Etiology, Pathology, and Prognosis.—(1) A Further Study of Prenatal Causes of Dento-facial Deformities, Dr. B. W. Weinberger, New York City.

VII. Practice and Technology.—(1) Subject to be announced, Dr. Calvin S. Case, Chicago; (2) Further Experiences with my Appliances for the Correction of Dento-facial Deformities, Dr. Ray D. Robinson, Los Angeles; (3) A Skeleton Bite-plane for Establishing a Normal Overbite, Dr. J. Lowe Young, New York City; (4) The Indirect Method of Anchor-band Construction, Dr. Martin Dewey, Chicago.

VIII. Legislation, Education, and Nomenclature.—(1) Report of the Committee on Education; (2) Report of the Committee on Nomenclature.

IX. Clinics.—A large number have already been secured, to be announced later.

X. Exhibits.—Manufacturers and publishers of books, periodicals, x-ray and photographic equipments, orthodontic appliances and supplies, have been invited to exhibit during the meeting.

Mouth Sepsis

Considerable attention has been bestowed on oral sepsis as an essential etiologic factor in systemic infections, and there is reliable scientific evidence in support of the tooth-root theory of this large class of diseases. The fact that chronic septic foci in teeth and elsewhere are exceedingly difficult to recognize in the majority of cases is undoubted. It is particularly instances of periapical infection or abscess that offer the greatest difficulty in this respect. Here, even a roentgen examination, which should always be made by an expert, may fail to render reliable aid.

Deland states that the diagnosis of mouth sepsis should be made by a dentist who is specially trained for this, in which opinion I concur. The physician, however, who encounters a case of systemic infection in which the teeth are suspected should refer the patient to a competent nose and throat specialist with a view to eliminating all foci other than those which may be present in the mouth before invoking the services of the specially trained dentist. It sometimes happens that multiple foci are discoverable, in as many different organs, as the teeth, tonsils and sinuses.

Successful treatment of secondary systemic infection demands, first and foremost, the removal of the septic focus or foci on which they depend. Before reducing the masticating surface of a particular patient, however, the evidences of an existing necessity for so doing should be as clear and convincing as possible. An attempt by a competent dentist should be made to heal the morbid lesions in and about the tooth roots, since some of these are amenable to expert management, before ordering the extraction of the teeth.

Within the past six months a number of dentists have informed me that countless teeth are being removed without justification, on the advice of physicians, usually following a roentgen examination (by amateurs in many instances). In well authenticated cases in which one or two teeth were the seat of peripheral infection, physicians have gone so far as to give emphatic directions to the effect that all of the remaining teeth be extracted. For example, one of Philadelphia's best known specialists in extraction was requested by a physician to pull out all of a certain patient's teeth—twenty—but he courteously, though firmly, declined to do so.

It seems to me that the rapidly growing custom of sacrificing teeth, many of which are merely suspected of being septic, can not fail to arouse the most ardent activity of dentists in opposition thereto, and must prove the ultimate chagrin of the medical profession. It would appear that an amazingly low estimate is being placed on the value of human teeth by an increasing number of physicians, who should appreciate the importance of a good masticating apparatus to the digestive function—to the maintenance of health.

I do not mean to disparage the significance of these latent chronic septic foci as a cause of secondary systemic infections or to depreciate investigations in this, comparatively speaking, new field of endeavor. The object of this letter is to utter a word of warning with a view to lessening what I believe to be an unwarrantable present-day sacrifice of the masticating surface, and to spare the medical profession the adverse criticism of the future, by a broader conception proper to the subject of oral sepsis and its management in the present.—*J. M. Anders, M.D., Philadelphia, Journal of the American Medical Assn.*

The International Journal of Orthodontia

Editor: Martin Dewey, D.D.S., M.D.

VOL. III | ST. LOUIS, JULY, 1917 | NO. 7

ORIGINAL ARTICLES

ORTHODONTIA—ITS PURPOSE, PROBLEMS AND POSSIBILITIES*

BY BERNHARD WOLF WEINBERGER, D.D.S., NEW YORK CITY.

THERE has existed for ages, a singular interest in the problems of how we came to be what we are, and why conditions exist as they do. We are an integral part of the series of forms and circumstances which surround us; this is not remarkable as the product of an orderly series of changes has left its record in the gradual ascending chain of organic forms.

In the past we have allowed the abnormal development of this form to continue along the line of least resistance, and through carelessness, ignorance, and indifference, have permitted, by unwisely advising patients, the child no opportunity to develop normally and under the most favorable conditions. It is then of the greatest importance to remodel the unsymmetrical features as the mental effect of a marked facial deformity has considerable influence in shaping a child's whole life.

Some of the most gratifying results of orthodontic treatment are seen in its influence upon mentality. When the bones of the face and head are undeveloped, and the nasal cavity is filled with adenoids and polypi, the child becomes stupid, inattentive, forgetful, and lacks the power of concentration because these growths obstruct the lymphatic circulation of the brain and prevent it from receiving the supply of nutrition necessary for its development.

The protruding upper lip, completely overhanging the characterless chin and retruding mandible, the lack-luster eye and lackadaisical expression are readily responsive to correction. Mouth breathing with adenoids and enlarged tonsils, and contracted nasal passages that are associated with it, can and should be improved.

Regularity of features and general animation of expression forms the distinguishing characteristics of the mouth, thus, strength of character is frequently judged wrongly by the expression about the mouth.

*Read before the Eastern Dental Society of the City of New York, April 5, 1917.

Early in the history of medicine, physicians recognized that specialization was essential, that the best and ablest could not obtain sufficient knowledge and skill to practice all its branches, and those who devoted a part or all of their time to certain fields were most likely to succeed. As men began to pay more attention to the teeth, dentistry came into its own as a profession, and through its development a greater appreciation of the importance of the preservation, development, function and relation of the teeth to the face has resulted. The continuation of this same appreciation, with the greater development of the above factors has brought about the science of orthodontia. Orthodontists might be called masters of individuality, inasmuch as they are daily engaged in attempts to change that portion of the human framework which contributes the most towards making up of that great factor. Therefore men who are engaged in orthodontia and in correcting irregularities of the teeth, are in duty bound to respect that field, to thoroughly understand not only the teeth, their structure, tissue changes, bone growth, peridental and adjacent membranes, but at the same time appreciate the importance of facial development, as well as the changes incidental to tooth movement and occlusion.

The dental apparatus has a much more complicated mission in life than masticating food. It is a complex structure with numerous functions into which enter not only the jaws, teeth, dental arches, alveolar processes, nasal passages and sinuses, but also the muscles which move the jaws, lips, tongue, palate, and throat.

Orthodontia deals primarily with the normal development of the dental arches and the teeth. It is directly associated with the internal and external face, and indirectly with the functions of nutrition, digestion, and respiration; hence to the series of related structures and functions, with the development and health of the whole bodily system.

The arrest of the growth and the disturbances of the function of the internal and external face, associated with many cases of malocclusion, are but symptomatic expressions of the disturbances of balance in nutrition and respiration, or of other vital functions; therefore, in general, malocclusion of the teeth may be considered the objective symptom of abnormal development of the dental arches, and the consequent arrest or deficiency of growth.

Until the importance of normal occlusion was thoroughly understood there was some justification for the use of empirical methods, both in diagnosis and treatment. Extraction of teeth to correct the deformity was then permitted, but not today.

Beside the knowledge of normal occlusion, a clear and certain conception of living bone tissue and its responsiveness to mechanical stimulation is just as important to the practice of orthodontia as the physiological effect of the use of drugs is to the practice of medicine. There are certain obscure principles to be observed in order to produce the desired results. These principles concern the physiological reproduction of bone induced by a given pressure. This is a subject that has never received the attention that it deserves by dentists or physicians. To orthodontists it is the foundation of structural work. I can think of nothing that is of greater importance, as in stimulating bone to its normal development, abnormalities can be corrected.

Noyes[1] defines bone, "as a connective tissue whose intercellular substance is calcified in layers which tend to be arranged around nutrient canals or spaces, with the cells arranged in cavities (lacunæ) between the layers and receiving nourishment through very minute canals (canaliculi) which radiate from the lacunæ throughout the layers." A study of the relation of bone shows three types of structures differing in the arrangement of the structural elements.

"The jaws are endo-membranous in their origin, but very early in their development a periosteum is formed over the surface of the bone already formed, and from that time on the growth of the bone as an organ is through the functions of the periosteum, together with the articular cartilages and the peridental membranes. By these tissues the bone is built up, but by the periosteum the surface is sculptured and molded into form, and by the osteogenetic tissues inclosed within the surfaces of the bone the internal structure is constantly being rebuilt, so as to adopt the organ to the forces to which it is subjected with the least possible weight. The more carefully this is studied the more evident it becomes that bone is formed and removed in response to mechanical stimuli, and that the entire surface is arranged in harmony with the mechanical stresses which result from the forces applied to the teeth and the surface of the bone."[2]

Albin Oppenheim[3] a few years later proved, by employing spring arches and wire ligatures, on monkeys, that positive changes do take place in the bone tissue incident to tooth movement, and that these changes occur in a definite and characteristic manner.

"Bony tissue," says Oppenheim, "be it compact or cancellated, reacts to pressure by a transformation of its entire architecture; this takes place by resorption of the bone present and deposition of new bony tissue; both processes occur simultaneously. Deposition finally preponderates over resorption. The newly formed bone spicules are arranged in the direction of the pressure. Increased pull has similarly addition of new bony tissue as a result, and simultaneous orientation of the spicules thereof in the direction of the pull.

"The entire transformation of the architecture and the orientation of the newly formed spongy bone spicules, always occur so characteristically and lawfully, that we can say by the histological preparations in what manner the movements were accomplished.

"This characteristic transformation results only upon the application of very slight, physiological-like influences.

"Should the force be too strong, the result will be such serious injuries to the periosteum, due to the disturbances in circulation, that there will be no typical reaction of the bony cells."

These experiments of Noyes and Oppenheim have brought about the present method of treating orthodontic cases, reducing the size of the expansion arch, at the same time proving definitely that slow movement is the correct procedure.

In addition to bone growth, various glands are stimulated to normal secretion, thus increasing nutrition to the brain by removing the pressure from the lymph and blood vessels. This has been proved by the Binet-Simon tests, for determining mental age. Backward children who are years younger in mind than in body, while under orthodontic treatment, show an advance in their reasoning powers, in their mental quickness and acuteness, that is most gratifying.

NORMAL CONDITIONS.

In our problems in orthodontia, let us first consider a normal mouth; unfortunately it is rarely met with today. An important factor in the study of oral hygiene is the fact that a perfect denture in normal use is practically self-cleansing, it presents the least opportunity for the lodgment of food, and the action of the lips, cheeks, and tongue in brushing the surfaces of the teeth, together with the action of the saliva, comes nearest to making them self-cleansing. In mouths where malocclusion exists, cleanliness is impossible. The crowding and overlapping of the teeth create triangular spaces in which food will accumulate, thus supplying a fertile field for the development, not only of bacteria which attack the surrounding tissues and produce pyorrhea and the decay of teeth, but also of those of infectious diseases.

Scarcely second in importance comes the matter of mastication. As a nation we have acquired the habit of bolting our food and consequently the lack

Fig 1.—Normal occlusion in child four years old; occlusal surfaces, upper and lower dental arches.

of the full use of our teeth. Too little mastication has a very injurious effect upon the development of the dental arches. Proper nourishment, as well as plenty of oxygen, is as essential to the normal development of the child, as exercise. If we would insure immunity from dental ills, we must guard the general health from infectious diseases and give the child its full opportunity for complete and harmonious development. To maintain this condition of cleanliness and health, the dental arches must have the "full complement of teeth," the arches must be nearly symmetrical, occlusion perfect, and mastication and respiration normal.

The Arches of the Temporary Teeth.—In order to have a clear conception of what constitutes occlusion, it is necessary to study the dental arches at the time when the deciduous teeth are all in their proper positions, and certain physiological processes are to take place, subsequent to the shedding of the temporary teeth and their replacement by the permanent teeth. In a great percentage of cases, malocclusion begins at the time when these processes are taking place. Fig. 1 shows, at the age of four years, a perfect development of the deciduous

arch in normal occlusion, at which time all of the deciduous teeth are in position and accomplishing the proper functions of mastication. Note the regular spacing between the teeth to make room for the permanent teeth which are a third larger than the deciduous, and the general roundness of the arch. Were this spacing present in every deciduous arch, orthodontia would be unknown. Fig. 2 illustrates the relation of deciduous teeth to the skull as a whole.

Fig. 2.—Relation of the deciduous teeth to the skull as a whole.

Fig. 3.—Occlusal surfaces of the upper arch; same child, four, six and a half, and eight years old, showing growth and development.

Fig 4.—Side view of case shown in Fig 3.

As the deciduous dental arch increases in size, the growth takes place in three dimensions—length, breadth, and height. Fig. 3 illustrates the upper arch of the same child, at four years, at six and a half, and at eight years of age. In the four years the alveolar process has grown downward in the upper arch,

and upward in the lower, the first permanent molars (sixth year molars) have come into occlusion, holding the arches in their proper relations. Fig. 4 shows the extent of development in length and breadth of the same cases placed side by side.

A study of the series of skulls from infancy to maturity will greatly aid in appreciating the growth of the jaws.[4] At birth all the deciduous teeth have developed and are embedded in the cancellous substances of the maxilla. When the crowns of the teeth are formed they are enclosed in crypts in the bone. The mandible is almost straight from the symphysis to the condyle, the angle is obtuse, and as the tooth develops within its crypt, pressure is exerted and the crypt wall is pushed backward through the cancellous bone. The bones of the face are not compact and rigid, but contain millions of active cells which are constantly building and rebuilding bone lamellæ, the result of mechanical influences to which the bone as a whole is subjected.

Some time between the seventh and ninth months the first incisors push through the roofs of their crypts and begin to erupt, causing absorption of the bony covering. The continued growth of the roots forces them occlusally and

Fig. 5.—Maxillæ about six to eight months. Note the relation of the cribriform tube to the crypts of the teeth (Series from the Army Medical Museum, Washington, D. C.)

Fig. 6.—About one year, showing relation of unerupted teeth.

the bone grows up, from the margin of the crypt, around them, increasing the thickness of the bone from below upward. (Fig. 5.)

At one year, all of the incisors are erupted and the temporary molars and cuspids are developing rapidly. (Fig. 6.) The roots are not fully formed, and each successively posterior tooth lies deeper in the bone so that their development transmits pressure which causes the teeth, already erupted to move either upward or downward, and forward and outward. The tooth germ in developing, exerts a pressure that causes the crypt wall to be pushed through cancellous bone until the resistance below is greater than the resistance above. In all the following illustrations of dissected skulls, I wish to call attention, particularly, to the relation of the lower wall of the crypt, the roots of the teeth and the inferior dental nerve canal. This relation, if not normal, will produce a nervous phenomenon that is so often found associated with the eruption of the teeth, for the entire surface of the gums, as the teeth erupt, are subjected to pressure which is the result of the growth of the enclosed organs.

At a year and a half the first temporary molar has erupted. At this age the roots of the incisor teeth have completely formed, carrying the lower teeth upward, forward and outward; the upper teeth downward, forward and outward. (Fig. 7.) They, as well as the entire bone, are moving in three dimensions of space. There is bone formation by the periosteum, peridental membrane and articular cartilage which is being transformed within, and, in fact, on all its surfaces. The bone formed today by the periosteum and the peridental membrane is next week destroyed and replaced by the Haversian system bone, only to be destroyed again, and again replaced.

At two and a half years (Fig. 8) the temporary dentition is complete and now the growth of the permanent teeth produces pressures which continue to force the temporary teeth occlusally, forward and outward. From this time until six years the temporary teeth, alveolar process and all, are moved through space, largely by the force of the developing permanent teeth.

While the temporary teeth are erupting they are continually being carried

Fig. 7.—Maxillæ about one year and a half.

Fig. 8.—Maxillæ about two years and a half.

occlusally by the growth of their roots, the alveolar process growing up around them. As the roots of the anterior teeth are completed they are still pushed forward, upward and outward, by the development of those distal to them. As soon as the temporary dentition is complete, the temporary teeth—alveolar process and all—are forced to move in three dimensions by the development of the permanent teeth, which lie in the crypts below them. The growth of the permanent incisors and cuspids first causes the development, chiefly in the anterior region; between the median line and the region of the mental foramen in the mandible, and from the suture to the cuspid region in the maxilla, and later the development of the bicuspids and second and third molars cause the growth which increases the distance from the mental foramen to the ramus. The development of the long roots of these teeth will carry the temporary teeth, alveolar process and all, occlusally, forward and outward.

If we examine sections of the alveolar process about the temporary teeth we shall see that this growth is accomplished by the formation of subperiosteal bone on the outer and inner surfaces, and subperidental bone at the margin of the process and around the alveolus.

In the production of the alveolar process the peridental membrane and the periosteum work together.

At about six years of age the first permanent molars erupt (Fig. 9) and take their place at the distal of the deciduous teeth. The way in which they lock determines the relation of the jaws to each other, as a deviation from the normal relation will entirely change the direction of the forces and will manifest itself in a modification of the development of the bones. They, being the strongest, as well as the largest teeth of the permanent set, bear the chief work in mastication, during the period of transition, while the permanent teeth replace those of the deciduous. They not only do the greatest work in mastication, but maintain the relation of the jaws to each other, for they act as a fulcrum which

Fig. 9.—Maxillæ about six years, showing first permanent molar, crowns of the developing permanent teeth; complete deciduous dentition. (Wistar Institute.)

balances the distribution of muscular force upon the jaws. If their relation is not normal each permanent tooth is disturbed as it erupts, causing all of the forces of muscular action to be perverted, thereby altering the distribution of functional forces upon the bone.

The first period of growth in the incisor region is caused by the growth of the permanent incisors and cuspids. This I would like to analyze more closely if time would permit. In the skull of about six years the first molars are in full occlusion, though their roots are not more than half formed. (Fig. 9.)

All the temporary teeth are now in their place, with the second molar in its crypt, and the bicuspids below the temporary molars. The growth of the dental papillæ for the cuspids has pushed back the floor of their crypts through the can-

cellous bone until the upper has reached the solid bone at the base of the malar process and the lower has reached the solid cortical layer at the lower border of the mandible. The lower centrals are being carried upward by the growth of their pulps in the conical ends of their half formed roots. The laterals lie

Fig. 10.—About the tenth year, second permanent molar partially erupted.

Fig. 11.—Maxillæ about the twelfth year, second permanent molars in position.

Fig. 12.—Adult dentition. Note the distance from the apices of the teeth to the lower border; and the relation of the cribriform canal.

to the lingual of the temporary cuspids. In the upper the central crypts rest against the solid bone of the floor of the nose, the lateral against the cuspid, and the cuspid against the base of the malar process. Their growth carries the temporary teeth and process forward, creating additional space between

the incisors and cuspids thus enlarging the arc. It is perfectly apparent that to have the result the teeth must preserve their normal contacts. If one incisor slips by to the lingual or labial it must be forced to lap more and more, and the arches are narrowed in proportion. There is no possibility that the bone will grow and make room for them; the mechanism which should cause the growth has "slipped a cog." The growth from the symphysis to the mental foramen in this period is then not an interstitial growth of bone, but a building on at the surface and rebuilding within, under the influence of mechanical conditions.

The growth of the bicuspids, and the second and third molars, augmented by the action of the inclined planes in occlusion, caused the development in the second period, and the increase in the distance from the mental foramen to the ramus. The forces at the back transmitted through the contacts, caused the teeth and bone to continue to move in the same direction. (Figs. 10 and 11.)

Fig. 13

Fig. 14.

Figs. 13 and 14.—Series of front views of previous skulls illustrating the growth of the maxillæ and mandibles.

After the second molar is in place the growth of the third should continue the action (Fig. 12).

During early childhood, in those cases where there has been a lack of vigorous mastication, and neglected use of the teeth; where there has been too little force applied in the action of the muscles in swallowing and respiration to create the necessary mechanical stimuli for carrying out the above development, there results a consequent lack of stimulus that should have been given to the cells of the bone. It is in such cases that we find this resistance so great, as to allow the teeth, especially the third molar to remain unerupted or impacted.

During the period of development of the teeth, we find the deciduous teeth under the influence of the permanent, move through three dimensions of space, in an occlusal, forward and outward direction. This growth is first chiefly in the anterior region, and then in the posterior. Between five and eight years of

age besides all of the deciduous teeth, we find all of the crown of the permanent set fully formed and occupying practically all of the space from the roots of the deciduous teeth to the cortical plate in the lower and the floor of the nasal chamber and the roots of the deciduous teeth of the upper. The permanent cuspid has pushed through its crypt into the cancellous bone until in the lower it rests against the inferior border of the mandible, while in the upper it is against the solid bone at the base of the malar process. All the teeth lie lingual to the roots of the deciduous, the central braced against the lateral, the lateral against the cuspid, the cuspid against the first premolar, and so on. As the roots of these teeth are formed they carry the teeth occlusally and outward.

Fig. 15.—Skull showing the wide distribution of nerves within and the close relation of the 5th, 6th, 7th, 8th, 9th, 10th, 11th, and 12th cranial nerves.

This development should move the deciduous teeth apart and they should become widely separated before being lost. If separation of the teeth has not occurred, the development is below normal.

We have seen then that the bone has not only been built on at the back, but that forces within it, at the back, and around it, have carried the anterior part forward. A series of front views of the same skulls, illustrate this growth (Figs. 13 and 14).

Some writers have minimized the importance of the causes of malocclusion, saying that orthodontists were not concerned with how the teeth came to be out of position, but with placing them in position. The first step toward the treatment of any case is to determine which of the forces of occlusion are

lacking or perverted, and the supplying of them by artificial means. The causes acting become the basis for the diagnosis, the treatment given and the prognosis. The perversion of forces in any case is by no means a simple problem, but upon the correctness of its solution depends the success of treatment. Teeth may be moved in any direction and almost to any extent, but they will remain only in the position in which all the forces to which they are subjected are balanced.

Before leaving this series illustrating bone growth, there remains one factor to which I wish to call attention, and although I can only dwell on it briefly, too much importance can not be given to it.

During the development and eruption of the teeth, the jaws are continually being rebuilt and transformed within, they are growing under the influence of mechanical stimuli, and in order to reach the full normal development, vigorous normal function is necessary. Where this has been normal, as the skull develops, there necessarily must be an increase in the distance from the floor of

Fig. 16.—Skull; normal occlusion in a child five years of age.

Fig. 17.—Premolars forced to erupt within the dental arch.

the orbit, or the floor of the nose, to the occlusal edges of the teeth. The inferior dental nerve should lie free between the apices of the roots of the teeth and the inferior border of the jaws, otherwise enough pressure will be produced to cause a reflex action and nervous symptoms.

The nerve supply of the teeth and associated structures are governed by the trifacial or fifth nerve, the largest of all cranial nerves. Fig. 15 shows the wide distribution within the skull, its close relation to the nerves and to the plexus and ganglia of the sympathetic system. "The intimate relations which the trifacial nerve bears with the points of origin of the sixth, seventh, eighth, ninth, tenth, eleventh, and twelfth cranial nerves in the floor of the fourth ventricle possibly explains many of those phenomena which are considered as reflex in character, and whose starting-point seems to depend upon some irritation of the fifth nerve, by means of various branches."[5]

Fig. 16 shows the skull with normal occlusion in a child of five years of age. Note the occlusion on the lingual surface.

To have a normal permanent arch retaining the deciduous teeth is of the greatest importance. These teeth are to serve until their permanent successors erupt; their presence aids development and their premature loss insures almost certain irregularities of the permanent teeth and invariably causes a retardation of development of the maxillary arch.

The sockets of the lost deciduous teeth will fill with new osseous tissues, hard enough in many cases, to turn the permanent tooth from the proper position, or through the forward movement of the teeth the spaces will close up, so that the permanent tooth will be compelled to erupt either inside or outside the arch. (Fig. 17.) The time to extract is when the permanent successor

Fig. 18.—Radiograph showing unequal absorption of the deciduous molar, thereby preventing the tooth from falling out.

Fig. 19.—Series showing teeth that had to be extracted as they were held in place owing to unequal absorption of the roots. The one on the extreme right is shown in Fig. 18.

is about to erupt, when abscessed, or when pericemental necrosis contraindicates further retention.

Prolonged retention is just as serious as the early loss of the deciduous teeth, especially the two deciduous molars. If these have not been lost by the twelfth year, radiogram should be taken to ascertain if the premolars are present, and if present, they should be extracted immediately. There are cases, where the absorption of the roots of these teeth are unequal, as shown in the radiogram (Fig. 18). This explains the retention of these molars until fourteen years or longer, thereby causing the impaction of the permanent teeth.

OCCLUSION.

As occlusion is the basis of the science of orthodontia, we must know what it means. According to Angle: "Occlusion is the normal relation of the or-

clusal inclined planes of the teeth when the jaws are closed." By referring to Fig. 20, which represents the teeth in normal occlusion, it will be seen that the external curve of the lower jaw is slightly smaller than the upper, so that in occlusion the labial and buccal surfaces of the teeth of the upper arch extend slightly over the lower. Normally each tooth of the dental apparatus oc-

Fig. 20.—Normal occlusion. (Peeso.)

Fig. 21.—Showing the linguo-occlusal relations. (Peeso.)

cludes with two in the opposite jaw, with the exception of the lower centrals and upper third molars. The incisors and canines occlude so that the incisal edges of the lower incisors and canines come in contact with the lingual surfaces of the corresponding teeth of the upper jaw near the incisal edges. The mesio-buccal cusp of the upper first molar is received into the buccal groove of the lower first molar. The teeth posterior to the molar engage with their antag-

onists in a precisely similar manner; those anterior interlock with one another in the interspaces, until the incisors are reached; of these the upper teeth usually overhang the lowers for about one-third the length of the crowns. The length of the overbite of the anterior teeth is the same as the lengths of the cusps of the molars, premolars, and canines. Fig. 21 shows the linguo-occlusal relations, except that the lingual cusps of the lower buccal teeth project beyond those of the upper into the oral cavity. In the transverse arrangement, the buccal cusps of the lower molar and premolar occlude with the buccal cusps of the upper; and the lingual cusps of the upper molars and premolars occlude with the buccal and lingual of the lowers. (Fig. 22.) By this arrangement, one-half of one tooth is always in occlusion with one-half of the opposite tooth. Nature has taken care to assure the retention of corresponding teeth through loss, by extraction or otherwise, and thus prevent rotation and elongation and the collapse of the entire arch.

In a careful study of the above occlusion one must not lose sight of a number of important factors. The occluding contact points must not be considered as surfaces or cusps, but planes; and while the occlusion of the central

Fig. 22.—Transverse arrangement. Normal occlusion of molars. (Cryer.)

and laterals is a simple arrangement, that of the canines, premolars, and molars is more complicated. In the case of the canine in place of one cusp we find four inclined planes, while the premolars occlude at eight instead of merely two points. On the other hand each of the molars present sixteen inclined planes, and not four cusps or points. The four inclined planes of each cusp, in turn, occlude with four of the inclined planes of four different cusps.

MALOCCLUSION.

Malocclusion of the teeth is simply a variation of these normal relations. It is a disturbance in the development of the dental arches that later interferes with the functions of respiration, mastication, and speech, thereby altering the dental apparatus, as well as the facial expression.

Etiology of Malocclusion.—Before discussing the causes of malocclusion, we must call attention to the impossibility of treating adequately this subject here. Were this to be gone into thoroughly, it would require a paper of great length, hence it is my purpose to interpret only certain common conditions pro-

duced by definite causes. The etiological factors of malocclusion may be divided into two groups, general, or constitutional, and local.

General or constitutional causes include those that affect the general functions of metabolism to such an extent as to interfere with the development of the teeth or the surrounding structures; e.g., diseases of childhood, such as rickets, measles, scarlet fever, and similar diseases affecting the epithelial structures; syphilis; faulty development caused through improper foods; bottle feeding; prenatal conditions and lack of use of the teeth through improper mastication.

Among the local causes are the early loss of deciduous teeth; prolonged retention of deciduous teeth; tardy and noneruption of permanent teeth; bad dentistry; supernumerary teeth; bad habits, such as lip biting and lip sucking; tongue habits; mouth breathing; adenoids and tonsils; abnormal frenum linguæ.

Early Loss of Deciduous Teeth.—The value of the deciduous molars in mastication is universally recognized by the profession, and an urgent appeal should be made to the parents for their preservation. The early loss of the deciduous incisors cause a lack of development in the anterior region of the arch. The early loss of the canines permit the incisors to drift toward the

Fig. 23.—Results of early loss of the deciduous incisors, incisors in contact with the premolars. Same case corrected, canine brought back into its proper place through expansion of the arches.

side from which the tooth is missing, often allowing the incisors to come in contact with the deciduous molars, thus preventing the permanent canines from coming into their proper position. (Fig. 23.) The loss of the deciduous molars permits the first molar to drift forward, resulting in an abnormal mesiodistal relation of the first permanent molar, and often in an impaction of the premolar when it attempts to erupt. The loss of the approximal surfaces of the deciduous teeth through caries, results in a lack of arch development, and such carious conditions should be observed in their earliest stages, and fillings inserted so that the approximal contact points may be restored.

Loss of Permanent Teeth.—A large proportion of malocclusion found in adults is the result of the loss of the permanent teeth. The tooth most frequently lost and the one that produces the malocclusion most difficult to treat, is the permanent first molar. Through the loss of these molars, the masticating apparatus is destroyed, the occlusion of the teeth ruined, and one of the greatest factors in pyorrhea is established (Fig. 24). To the student of occlusion, the changes in occlusal relations after the first permanent molar has been lost, are more or

less well known, and it is comparatively easy to foretell what will occur, and to follow the stages whereby the ruin of the whole dental arches has been accomplished. Loss of the first permanent molar allows the second molar to tip forward, and this is followed by the drifting distally (posteriorly) of the teeth mesially (anteriorly) to it (Fig. 25), destroying the occlusion of that side or both sides of the mouth, and contracting the arches, both upper and lower. The effect of this can be seen in the overlapping of the anterior teeth. In addition, the incisors will be found to occlude against the gum margin of the upper teeth as in Fig. 26, instead of the upper third of the upper teeth as in Fig. 20. A frequent question asked of the specialist by parents and practitioners is as to

Fig. 24.—Cast of a young girl, fourteen years of age, teeth lost through pyorrhea.

Fig. 25.—Model showing the left second molar tipped, drifted forward, due to the extraction of the first molar.

Fig. 26.—Showing the under teeth elongated and entirely over the lowers; *b*, corrected, the lower teeth no longer in contact with the palate.

the advisability of extraction of one or more of the deciduous, as well as of the permanent, teeth in order to "make room" for other teeth. That is a false theory, and one that has caused no end of trouble. Instead of the arch being made larger, the reverse is true, and the arch already contracted becomes so much more so. The result is the shortening of the arches (Fig. 27), producing a facial deformity in which the chin is too close to the nose, and there is a sunken appearance about the mouth. (Fig. 28.)

Mouth Breathing.—Mouth breathing has long been recognized as a cause of malocclusion, and is generally the result of adenoids. It is an accepted fact by both rhinologists and orthodontists, that a hypertrophy of the pharyngeal

tonsils, commonly known as adenoids, will produce a malformation of the superior and inferior maxillæ and adjacent parts. Nasal obstruction is the indirect cause of this maldevelopment. The direct cause is the constant prevalent muscular action, causing mouth breathing. (Fig. 29.) The growth of the nasal cavity affects the growth of the maxillary bones, and likewise anything that affects the growth of the maxillary bones will have an influence on the nasal cavity. Muscular pressure plays an important part in development. (Fig. 30.) Normal respiration during the developmental period exerts the greatest influence upon the growth of bone. With the mouth closed, the lips are pressed against the labial surfaces of the incisors, the lower lip covering about one third of the upper incisors. The tongue fills the vault of the palate and presses against the lingual surfaces of the teeth and bone. The air being partially exhausted

Fig. 27.—Showing the dental arches shortened; lack of alveolar process due to noneruption of teeth.

B

Fig. 28.—Showing facial deformity in which the chin is too close to the nose, with sunken appearance about the mouth. See Fig. 27 showing the dental arches.

by the soft palate lying against the base of the tongue, causes a downward pressure against the nose. In mouth breathing the tongue does not exert force on the upper teeth, and therefore allows the maxillæ to remain undeveloped. As a result of atmospheric pressure, the mandible drops down, the depressor muscles preventing it from developing forward.

The function of deglutition is quite as important as that of breathing, and is seldom if ever normal in abnormal breathers. With each act of deglutition the teeth are pressed firmly together by the contraction of the elevators of the mandible, exerting pressure upon the lingual surfaces of the upper teeth and the buccal surfaces of the lower. This causes a mechanical stimulus for the growth of bone carries the apices of roots buccally and lowers the roof of the

mouth, consequently increasing the depth of the nasal cavity from above downward.

Expanding the arch of a young patient, while it may not actually lower the floor of the nose and straighten a defected septum, has the effect of relieving the upward pressure and preventing the further development of a deflected septum. It is useless to correct a deflected septum and remove adenoids and tonsils, and yet allow mouth breathing to continue, and not try to establish normal occlusion and render normal breathing possible. It is just as useless to try to establish normal occlusion of the teeth without first removing the primary cause of the mouth breathing. The rhinologist for the success of his work is, in many cases, dependent upon the orthodontist.

Fig. 29.—Frozen section. (Cryer.)

Early Disturbances.—Disturbances in development occur in early life. Both pronounced protrusion and retrusion have been observed by the author, in children three years old or younger, even at birth, indicating defects in development perhaps congenital in origin (Figs. 31 *A*, *B*, *C*, and *D*). These disturbances occurring in early life, if not corrected before the seventh year, in some cases earlier, lessen the possibility of permanent benefit, especially in the establishment of normal respiration.

One of the most beneficial results—perhaps the greatest—of the study of occlusion, as well as prenatal influences, has been the change in the time for beginning treatment. Under the old idea it was necessary to wait until the patient was thirteen or fourteen years old, until the second molars and all the

permanent teeth had erupted before treatment was begun. Now cases ***should be completed*** by the time the second molars are in full occlusion and all the cusps normally locked (twelfth year). Early treatment should be and is advised as these cases are always progressing (Fig. 32). As soon as a definite defect in the mechanism of development is discovered, then is the time to correct it, in order that development may not progress abnormally, thereby destroying

Fig. 30.—Section of frozen skull showing adenoids and tonsils.

the hope of overcoming prolonged conditions caused by improper occlusion, facial expression, and structural changes in osseous and muscular tissues which can not be benefited by treatment.

Treatment.—A word or two in regard to "regulating appliances" and "sys-

tems" used in treating malocclusion of the teeth. Regulating appliances are but mere mechanical devices for the purpose of bringing malposed teeth into their proper positions and occlusion, by creating cell activity. The appliance must be mechanically perfect, otherwise pressure is exerted in the wrong direction

A *B*

C *D*

Fig. 31.—*A, B, C, D.* Series illustrating a disturbance in development at birth.

Fig. 32.—Showing a progressive case, six months, one year, eight years.

and the work will result in failure. The mere exertion of force is not sufficient to allow the teeth to assume a proper position in the "line of occlusion;" the movement must be physiological, and cell activity must be created.

Teeth can be moved anywhere, but where improper force has been used

they can not be held in their new position, and considerable suffering is caused. Time is the one great factor in orthodontic work; old bone must be destroyed, cell activity must be created, and new bone formed.

Regulating appliances are of two types, fixed and removable. Fixed appliances are those placed on the teeth in such a manner as to be removed at the to be handled or removed only at the will of the operator. Removable appliances are those placed on the teeth in such a manner as to be removed at the will of the patient. They are recommended, because they may be removed by the patient and the teeth cleaned after each meal. They are not as conspicuous as the fixed appliances, nor are they as efficient. The great disadvantage of their not being securely attached to the teeth is the limit of use and lack of control. A greater amount of pain is caused owing to the constant putting in and taking out of the appliance, which causes undue pressure in the wrong direction, and while it is out, the teeth return to their original position, thus creating unnecessary inflammation. The appliance being constructed, if worn constantly, so as to rest directly upon the lingual surfaces of the teeth and the adjoining tissues, creates a stimulus where none is needed, and an unnecessary pressure on the surfaces. Such an appliance is bulkier, and is less permanent in results.

Fixed appliances have the advantage of firm attachment, both to the anchor teeth and to those that are being moved. Thus appliances can be smaller, and when the force is rightly applied the operator is assured that it will continue in the right direction and the result is bound to be more lasting.

CONCLUSIONS.

Normal occlusion as the basis of orthodontia, has taught that the full complement of teeth is absolutely necessary in order that the teeth may perform their proper function, that extraction of teeth to accomplish the result is unnecessary; yes, even criminal.

Modern orthodontia requires a thorough knowledge of the physiological development of the dental arches and associated structures, the remote as well as the local etiological factors, proper diagnosis, classification, and treatment, based not only upon mechanical principles but physiological as well.

The associated structures are hindered in development where the dental arches are arrested in their development.

Orthodontic treatment should be begun early, in order that the case may be completed by the time the second molars are in proper position as the disturbances occur early in life.

Every child should be given an opportunity to develop normally, permitting marked facial deformities to be corrected with normal functions of nutrition, digestion, and respiration, in order that the whole bodily system may not be interfered with, thus leading to serious results.

BIBLIOGRAPHY.

[1]Noyes, F. B.: The Alveolar Process, Am. Orthodontist, May, 1908.
[2]Noyes, F. B.: Index to Personality, Dental Review, October, 1910.
[3]Oppenheim, Albin: Tissue Changes—Incident to Tooth Movement, Am. Orthodontist, October, 1911.
[4]This study of a series of skulls is taken from several articles by Noyes.
[5]Ranney.

COOPERATION OF DENTIST AND ORTHODONTIST*

By J. Lowe Young, D.D.S., New York City.

THE profession of dentistry, while new in comparison with that of medicine, has now reached the stage in its evolution, where, for the best interests of the laity, division of labors and responsibilities must be recognized, as determined many years ago in the older profession. About twenty years ago there were occasional minds so impressed with the necessity of more thorough efforts in the correction of malocclusion of the teeth that they decided to limit their practices to work of this kind. From this beginning, the specialty of orthodontia developed and was the second specialty in dentistry, being antedated only by exodontia (known at that time as the specialty of extracting teeth). Subsequently, developed oral surgery, prosthodontia and periodontia. The thought that orthodontia, like exodontia, was so distinct and separate from other dental operations, that there was little or no overlapping of labors or responsibilities, was responsible for its being among the first of the specialties to be established in dentistry. How true this is we will see later.

That other specialties will develop there is not the slightest doubt, but just in proportion as there is an overlapping of labors and responsibilities, will difficulties be encountered, for it is but human to blame the other fellow where possible. I am convinced that in the near future, there will be those who will give their entire attention and effort to the treatment and filling of root canals. This is made possible by the x-ray, for it would indeed be a bold man who would undertake such a specialty without being able to show in a positive way the results of his labors. That the laity will be better served when such a specialty is established, there is not the slightest doubt, for, the person who is doing any one thing all the time becomes more proficient than he whose attention is divided. As proof of this, consider the many things used in the various walks of life, that are made by artisans of mediocre ability, but fashioned with such ease and dispatch that the cost of production is very small, compared with what it would be if done by one with many other interests. These artisans become specialists in their particular labors and the products from their hands, when compared with those of the average are vastly superior, notwithstanding that the cost of production was less. Who would think in this stage of our civilization to set one man to build a modern house, he to manufacture everything that entered into it, from the raw material? To attempt this would be to set back the wheel of progress for centuries.

The first aim of the true professional man should be to serve his clientele in the best possible manner, regardless of his individual requirements or bank account. But some of us will argue that if we followed this course, we would have nothing to do, as Dr. A. is recognized as the best man in oral surgery and Dr. B. the best man in prosthodontia and so on down the line. The answer is

*Read before the First District Dental Society, S. N. Y., Feb. 5, 1917. Reprinted by special permission from *The Journal of The Allied Dental Societies*, June, 1917.

Fig. 1.—Front and side views of normal occlusion of the deciduous teeth, when the second deciduous molars are in full eruption.

Fig. 2.—Deciduous teeth in malocclusion, the teeth on the upper right side biting lingual to the lower ones.

Fig. 3.—Occlusal view of same case, showing that the upper and lower dental arches are practically of the same width in the molar region. This condition never prevails in normal deciduous dental arches.

for us to become as proficient as any one in our community, in some one or as many branches of our profession as possible and then refer to others such work as we do not feel that we can do in accordance with our ideals, for it is only by so doing that a conscientious professional man can continue in practice. How many of us take this view of our profession, and yet how prone would we be to criticize the medical practitioner who would without any previous training or experience undertake an appendectomy, particularly if the operation was on one of our immediate family and did not prove successful?

It does not follow that if the above conditions obtained, all dental opera-

Fig. 4.—Three sets of casts made at five, six and eight years of age respectively. The one on the left shows pronounced spaces between the deciduous teeth. The middle one has the lower permanent centrals erupted with spaces still between them and the approximating deciduous teeth. The one on the right side has all eight permanent incisors in eruption. This took place without any orthodontic treatment, and is Nature's method where normal eruption is not interfered with.

Fig. 5.—How the permanent incisors develop back of, or lingual to the roots of the deciduous one. (Noyes.)

Fig. 6.—How the cuspids and premolars develop in relation to the deciduous ones. (Noyes.)

tions would be satisfactory to the patient, for we differ in ideals as widely as we do in technical ability. But if we are conscientious in our efforts in every operation we undertake, always striving to do it better than the previous one and thus more nearly approach perfection, our ideals will rise in proportion as we improve in our technical ability, and this is the foundation of all professional progress, having always in mind the Golden Rule, "Do unto others as you would have them do unto you."

That we have in every large city in this country one or more specialists in orthodontia and that the number is rapidly increasing, proves conclusively that there are many members of the dental profession who recognize that this work can better be done by the specialist. It might not be amiss for us to consider here why this is so. One teacher of orthodontia has often been heard to proclaim that orthodontia and dentistry are like oil and water and will not mix. But why? Is it that orthodontic operations are more difficult and require a higher order of technical ability or a keener appreciation of the artistic? No. Then why? Orthodontia demands that the malocclusion be corrected. In order for us to correct malocclusion we must have a clear and definite understanding of this ideal condition which we are attempting to restore.

Normal occlusion implies that all the teeth in one jaw are occluding with the teeth in the opposing jaw, so as to furnish the largest area of grinding

Fig. 7.—The resorption of the roots of the deciduous teeth and the bone surrounding them. As the permanent tooth erupts new bone must develop to support it. (Noyes.)

Fig. 8.—A diagrammatic chart, prepared by Dr. Wm J Brady, showing development, eruption and resorption of the teeth, that I have found very valuable in explaining to the parents the necessity for early treatment of malocclusion.

surface. The cusps, the inclined planes, and the sulci into which they fit should combine to furnish the owner with the best masticating apparatus, thus forming dental arches which in regard to strength and durability can not otherwise be equaled. The cusps of all the grinding teeth in such arches, interlocking with their antagonists, tend to prevent these teeth from any variation in position either bucco-lingually or mesio-distally. This regularity of the teeth in normal arches is also one of the chief factors in their resistance to decay, and to disease of the surrounding tissues, for the teeth, if they are properly formed, are in a position to be as nearly self-cleansing as possible.

With this conception of normal occlusion, it is apparent that the loss of one tooth or of even one cusp of one tooth, or to be more exact, the loss of

Fig. 9.—The result of constant biting of the tip of the tongue, preventing the eruption of the permanent incisors.

Fig. 10. Fig. 11.

Figs. 10 and 11.—The result of biting the cheek, forcing the lower molars and premolars of the left side, entirely lingual to those of the upper teeth.

Fig. 12.—Casts of a child of eight years, that has always sucked the left thumb. Observe a slight distal relation in the molar region with a protrusion of the upper left central and lateral The right side was practically normal.

any portion of the mesio-distal diameter, will destroy to just that degree, both normal structure and normal function. It is also apparent to those who have seriously studied this question that it is of equal importance properly to restore the mesio-distal diameter of the deciduous molars where fillings have been inserted on their proximal surfaces. Hence, if we are properly to correct mal-

Fig. 13. Fig. 14.

Figs. 13 and 14.—Pronounced retrusion of both the upper and lower incisor teeth, the mesial-distal relation of the molars being correct This condition was caused by contracting the lips.

Fig. 15.—Normal shape of the occlusal surfaces of the teeth. Note particularly the marginal ridge on the mesial-distal surfaces of every bicuspid and molar. Where these ridges have not been lost through dental caries, the danger of food particles being forced between the teeth is almost nil In the restoration of the occlusal surfaces of the teeth with fillings and inlays, it should be the object of every conscientious operator to try to reproduce these marginal ridges.

occlusion, we must have in our mind's eye the form, surfaces, and the positions of the dental organs when normal. The value of proximal contact, the proper occlusion of each cusp, the antagonist of each inclined plane, the size of each

fossa, the shape of each sulcus and the direction of each groove should be known to him who aspires to assist nature to establish the normal.

When teeth are in malocclusion we must in some way be able to figure out from the beginning what must be done in order to put them in their normal posi-

Fig 16.—A case having ten large gold inlays on the occlusal surfaces of the teeth where a good attempt has been made at anatomical restoration of the marginal ridges.

Fig. 17.—The same case with the inlays colored so as readily to be seen.

Fig. 18.—Normal arrangement of the teeth from the buccal view.

tions. This can be done only by procuring a set of accurate plaster impressions in order to make casts of both dental arches, so that we can place the teeth of the arches in the position they now occupy and be able to study them from the lingual as well as from the buccal view. It is not a difficult thing to make a set of casts, I hear someone say. No. But the casts are of little value if we do

not take time to study them and accurately determine just what is necessary to do. This is where the dentist usually makes his first slip. He does not take the time accurately to figure out what he must do with the teeth in malocclusion so as to place them in occlusion.

Orthodontic appliances, to be efficient and comfortable, must be so delicate that there is always a possibility of a break, and it is imperative that this should be remedied at once, for teeth relapse much faster than it is advisable to move them during correction. The busy general practitioner finds it difficult to care

Fig. 19.—Normal arrangement of the bicuspids and molars from the lingual view. This is really the most important aspect from which to view the occlusion of the teeth, and can only be done on the patient by means of casts.

Fig. 20.—Cross section through the molar region. Please note how the buccal cusps of the upper teeth overhang those of the lower molars. Wherever this condition prevails, and the teeth are all present, there is little or no danger of biting the cheeks. (Cryer.)

for these emergencies owing to lack of time with his full list of appointments, and consequently the work is neglected, and possibly forgotten for a time. Slip number two.

It is the duty of the dentist, in referring a case to be corrected, to see to it that the condition of the oral cavity of his patient is what it should be to receive a set of orthodontic appliances, for it must be remembered that in the majority of such cases, appliances of some sort will be required at intervals if not

continually for several years, depending on the magnitude and complications of the case. All carious places should be filled and all roughened or etched enamel surfaces should be thoroughly polished according to oral prophylactic standards, so as to place the teeth in the best possible condition to be kept clean and free from bacterial masses during the orthodontic treatment.

It is the duty of the orthodontist before accepting a patient, to impress upon him, the parent or his guardian, the importance of thorough cleansing of the teeth, and to state clearly and emphatically that any mechanical appliance placed in the mouth renders them more difficult to keep clean, but that if instructions are faithfully followed, it is quite possible to do so. It is also his duty to see to it that his patient has the proper tools with which to work. There are few adults who effectually care for their teeth. One reason of failure is that they work one toothbrush overtime, never giving the bristles a chance to dry and regain their elasticity. A toothbrush used more often than once during the day becomes inefficient. Brushes should be numbered so that the patient can readily select a fresh brush each time he brushes his teeth during the day.

The orthodontist should be willing to state at the beginning that he will assume the responsibility of guarding against any injury to the enamel surface or to the surrounding tissues under cemented bands, provided the patient will report for inspection at stated intervals. This will tend to make him more careful in his technic in fitting and cementing bands. In order to avoid complications he should emphatically state that it is not uncommon for initial cavities on the proximal surfaces of the teeth to be so small that it is impossible to discover them without resorting to a wide separation, particularly on the mesial surface of the first permanent molars. In fact these teeth are so generally affected owing to the very broad contact formed by the second deciduous molars, that it is almost permissible that he mark on his chart with a question mark, all such surfaces that have not been filled. It is obvious that any dentist can readily distinguish the difference between such a cavity and one caused by a loose or ill fitting band, but to the laity, a cavity in a tooth that has been banded is blamed on orthodontia and it is the duty of the dentist to enlighten his patients on such points, if he wishes to cooperate to their advantage.

The age at which patients should be referred to the orthodontist is a mooted question, but it is safe to state that ninety-five per cent of orthodontists will agree that all orthodontic treatment should be completed by the time the permanent teeth that replace the deciduous ones, are in full eruption. Orthodontia then becomes an aiding process, and the final results the best that can possibly be obtained. It is proper to consider at some length why this is so.

The deciduous denture consisting of twenty teeth is complete at the end of the third year, and when normal, the lower teeth are found to be in a definite relation to the upper ones. The incisors both upper and lower are in contact with their approximating neighbors. By the time the first permanent molars are in full eruption, if normal development is not interfered with, there will be a decided change in the size of the deciduous dental arches, resulting in spaces in the deciduous incisor region, both upper and lower. Whenever such spaces fail to appear, it is safe to assume, that there will not be sufficient room in the anterior part of the arches to accommodate the permanent incisors when they erupt, owing

to the fact that these teeth are always considerably larger than the deciduous ones which they replace. This lack of room for the erupting incisors frequently results in what might justly be considered impaction of a number of teeth. That this crowded condition of these teeth is responsible for reflex disturbances which result in baneful manifestations that work to the detriment of the child, is apparent to those who have seriously considered this subject. It is quite common

Fig. 21.—Shows that the dental profession is still advocating the extraction of teeth for the correction of malocclusion. Four first bicuspids removed.

Fig. 22 *A*.—Occlusal view of pronounced case of malocclusion before treatment. See Fig. 22 *B*.

for children at this age to develop habits of various kinds, such as tongue and lip biting, sucking the thumb or finger, biting the nails, biting the cheek, drawing in the lips in various ways, pressing the teeth with the tongue, licking the lips, etc. That these habits are the result of reflex disturbances, it is fair to assume. That such habits influence adversely the positions of the erupting teeth is generally recognized and if persisted in, the correction of the malocclusion is a useless process, as the teeth are certain to relapse as soon as freed from mechanical retainers.

Physicians have occasionally been known to advocate that infants be permitted to suck the thumb, on the ground that it prevents mouth breathing, but all who have encountered such cases will agree that of the two evils the latter is easier to correct.

It therefore becomes the duty of every dentist, as well as that of every physician, if he wishes to cooperate to the fullest extent for the benefit of children

Fig. 22 *B*.—Occlusal views of a pronounced case of malocclusion after treatment. See Fig. 22 *A* These prove the fallacy of such treatment.

intrusted to his care, to be ever watchful for such manifestations, so that he may use every possible means to break up such habits at the beginning, for the longer these habits are continued, the more difficult they are to overcome. It is a rare thing to find parents who are cognizant of the habits of their child, and when they are, they have not the slightest conception of the baneful effects of such habits. Wherever possible to ascertain the cause of the habit, the cure becomes far more certain.

As the root of the deciduous tooth is resorbed, the bone surrounding it is also resorbed, and as its permanent successor erupts, new bone develops around it to support it. Owing to the fact that the crown of the erupting tooth projects below the gums before the root is fully formed and, also, since there is never any attachment of any kind to the enamel surface of the tooth, it must be obvious that the pressure required to rotate or guide such a tooth into its proper position is very much less than that required to move a tooth in full eruption with the bony socket surrounding it fully formed. Is it not logical that when teeth are guided into their proper positions during the natural eruptive period, so as to place their inclined planes in an harmonious relation with their antagonists, that we are assisting nature to the greatest degree? Is it not fair to assume that teeth so moved are surrounded with bone far more normal in cell activity and structure and therefore better able to withstand invasions of disease, than where resorption of bone has been induced by mechanical means and the teeth held by some device until new bone has developed to sustain them? Who is there that will dare to assert just how long it is necessary to retain teeth that were in full eruption with their bony sockets and surrounding membranes fully developed before the moving process was instituted?

Observation has proved that wherever it is possible to have finished orthodontic treatment by the time the permanent teeth that replace the deciduous ones are in full eruption, the buccal surface of the second permanent molar. is far less liable to be attacked by decay than where these teeth are present at the beginning of treatment. This of course is due to the difficulty experienced in properly cleansing these teeth with appliances of any kind attached to the buccal surface of bands on the first permanent molars. It likewise follows that it is safer to band the first permanent molars whenever possible for anchorage for the appliance rather than the second deciduous molars, as any attachment on the buccal surface of bands on these teeth renders the first permanent molars more difficult to keep clean.

Other reasons why it is better that treatment should be finished at this age, are, that children do not object to appliances even if they show; that their tissues possess far greater recuperative powers; that the strain of their school work is lighter and that it is finished prior to puberty, which is usually a strain on both male and female.

In the face of the above how can any conscientious dentist advise parents to delay treatment until all permanent teeth are present?

Close observation will prove that children who erupt deciduous teeth early will usually erupt the permanent ones early, and if the dentist would bear this in mind, he would be the better able to know just when he should refer his patients so as to assure that they will derive the greatest benefit from orthodontic treatment. In all cases of Class II or Class III malocclusion, if treatment can be started prior to the eruption of the first permanent molars, the final results will be found to be more satisfactory to all concerned.

That many parents consult an orthodontist without being referred to their dentist must tend to prove that the members of the laity are far more interested that their children develop normal occlusion than are their dentists, and it is they who should answer why this is so. The great majority of such children are

found to possess pronounced malocclusion and many of their mouths are woefully neglected, both as to oral prophylaxis and filling of initial cavities. Can it be possible that such conditions are due to negligence of the parents? If so, then why are they so anxious about the malocclusion?

Fig. 23.—The occlusal view of a case before treatment. Observe the upper right lateral almost in contact with the bicuspid and the upper left first molar almost in contact with the first bicuspid.

Fig. 24.—Dental arches developed sufficiently to accommodate all of the teeth.

Many of these parents cooperate to the fullest extent during the corrective treatment and when the children are referred to their dentists to have the teeth and mouths put in a proper condition to receive orthodontic appliances, they not infrequently return with the statement that the cavities have all been filled; yet one may find that prophylactic measures have been neglected and often deep cavities in

the occlusal surfaces of the permanent teeth have not been filled. It is obvious that this places the responsibility for such conditions where it belongs.

Apropos to the subject, I quote from a paper by Dr. Grace Rogers Spalding under the title of "Practical Measures of Preventive Dentistry for the Orthodontist," published in the January, 1917, *Dental Items of Interest,* as follows:

"It is difficult for a specialist in our profession to obtain from the general practitioner that complete cooperation which is so essential to success in the ultimate results. There is no specialty of dentistry which is so dependent upon correct dental restorations as orthodontia. In other specialties faulty dental operations are usually recognized before irreparable injury has been done, while in orthodontic cases the shifting of teeth back to their original positions, due to faulty contour, defective contacts and imperfect occlusal restoration is usually so gradual that the occlusion of the teeth may be changed and the purpose of the orthodontist's work entirely defeated before this is discovered."

To offer a solution for this problem is exceedingly difficult, since there will always be dentists and *dentists.* As dental art advances, the technic of the individual operator will naturally improve, but the writer believes that the inevitable solution will eventually be the prevention of all cavities for orthodontic patients during as long a period of time as the patient is under the observation of the orthodontist. After this there should be but little difficulty in preventing caries, for such a patient would probably give his teeth, which would then be in normal or nearly normal occlusion, that intelligent care which alone can and does prevent dental caries. If only the prophylactic specialists and the orthodontists could cooperate to such an extent and together care for a sufficient number of cases to verify conclusions according to our present enlightenment in this direction, the result would be a step forward in preventive dentistry.

In this connection it is deemed advisable to insert two quotations from a paper by your essayist published in the *Dental Items of Interest,* May, 1913, entitled "Restoration of Occlusion by the Casting Process."

"Did it ever occur to you that the orthodontist often works for years to build up this normal occlusion, only to have it pulled down in a day by the ruthless extraction of a single tooth, or by the lack of restoration of cusp contour or proximal contact in making fillings or inlays?

"It would seem, therefore, that the dentist must share the responsibility of the orthodontist in emphasizing the importance of normal occlusion by preserving it at all times, or at least by not destroying it.

"One of the great difficulties experienced by the orthodontist is to retain the mesio-distal relation after it has been established. Very frequently this trouble is due to improper fillings, or inlays, on the occluding surfaces of the teeth, particularly those of the lower first molars. If these restorations can be made so as to reproduce accurately the original shapes of these teeth, and thus permit the large mesio-lingual cusp of the upper first molars properly to seat itself each time the teeth are closed, do you not see what a powerful influence is exerted by the action of the inclined planes of this cusp on the inclined planes of the cusps of the lower first molar, to prevent a return to a mesial or distal malocclusion, and do you not see that to a proportionate degree each reproduction of the normal occlusal surface of a tooth exerts a like helpful influence? Where all restorations

accurately reproduce the original anatomical land-marks, the orthodontist will experience much less difficulty in the retention of such cases."

Occasionally parents who have had their dentist begin treatment of malocclusion for their children, become dissatisfied and consult an orthodontist. In such cases if the appliances are in place, it is the duty of the orthodontist to refer such a patient back to his dentist so that he may remove them, and not till then is the former at liberty to have anything to do with the case. In like manner a dentist should not for any reason remove for his patient, appliances put on by an orthodontist, but should refer them to the man who put them on for removal, and due courtesy should demand that he communicate to the orthodontist, his reason for desiring their removal.

If a patient should decide to change from one orthodontist to another, which he has a perfect right to do, the second orthodontist has no right to consider the case as long as the child is wearing appliances unless he has received permission from the other to proceed with the case.

In all such cases where a patient changes from one practitioner to another for orthodontic treatment, it is the duty of the first operator to deliver to the patient the original casts and photographs if such have been made (provided of course that all financial obligations have been settled), cooperating in every way that will best serve the patient's interest, for it is obvious to every orthodontist that to treat a case without possessing casts of the original positions of the teeth, places him under a handicap, and this is not for the best interest of the patient.

It is not uncommon for dentists, in referring a case of malocclusion, to give the parent the names of several orthodontists, so that he may have a choice. This is a practice we cannot too strongly condemn. It is far better that he should decide who would be the best qualified to suit the individual needs of his particular patient and send him to that person. The patient will be far better satisfied and the dentist much less annoyed, and he will save himself the humiliation of stating to the patient which one of the number he considers the most competent.

ORTHODONTIC MECHANICS: DENTAL ENGINEERING

By Rudolph L. Hanau, Consulting Engineer, Pittsburgh, Pa.

Force may be defined as that which causes, or tends to cause, or to destroy, motion.

Resistance is that which is opposite to an acting force. It is equal and opposite to force.

Velocity equals space divided by time.

Work is the overcoming of resistance through a certain distance. It is measured by the product of the resistance into the space through which it is overcome.

Energy, or stored work, is the capacity for performing work. It is measured in the same units as is work.

Power is the rate at which work is done, and is expressed by the quotient of the work divided by the time in which it is done.

With a clear conception of these fundamental definitions of mechanics, it will be convenient to accept the following arbitrary units of measure:

F=Force in grams (g)

R=Resistance in grams (g)

D=Distance in millimeters (mm)

T=Time in weeks (w)

V=Velocity in millimeters per week $V=\frac{D}{T}=\frac{mm}{w}$

E=Work or Energy in millimeter grams $E=F\,D=g\ mm$

P=Power in millimeter grams per week $P=\frac{E}{T}=\frac{F.D}{T}=g\frac{mm}{w}$

A=Area in square millimeters (mm^2)

C=Volume in cubic millimeters (mm^3)

We know that teeth can be moved and have observed that constant gentle forces correctly applied give satisfactory results in orthodontic treatment. It will be assumed in this writing, that we are able to apply forces in predetermined directions. The factors that will concern us in this discussion relative to forces in orthodontics are magnitude, duration of application and the displacement of bone tissue they cause.

Fig. 1 represents a cuspid in side plan view. The dashed outline indicates the position into which the tooth has been moved. The section below the heavy horizontal line in the figure is bone material, the horizontally shaded portion in the drawing indicates the absorbed bone tissue, and the vertically shaded area, regenerated bone tissue. The resistance that the bone material offers to the movement of the tooth (be its cause of physical or physiological origin) must be overcome by forces. By means of devices (appliances, etc.) forces of proper magnitude and direction are introduced.

From a mechano-orthodontic point of view, the tooth may conveniently be divided into two main parts; i.e., the root embedded in the tissue and the crown

which ordinarily projects into space. The forces may be applied on a point, a part of, or the entire surface of either the crown or root as conditions may warrant. Similarly, the equivalent reaction, or the resistance to these forces, may act on a point or area of the crown or root, or both, as the case may be.

An axial bodily movement requiring only one force is illustrated in Fig. 2. A movement requiring at least two forces is shown in Fig. 3.

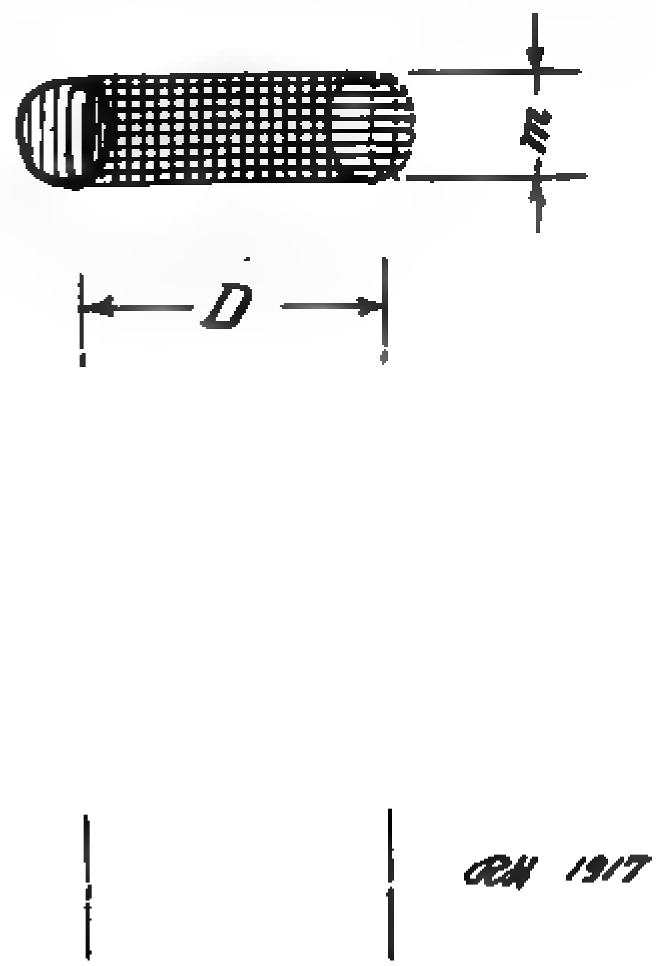


Fig. 1.

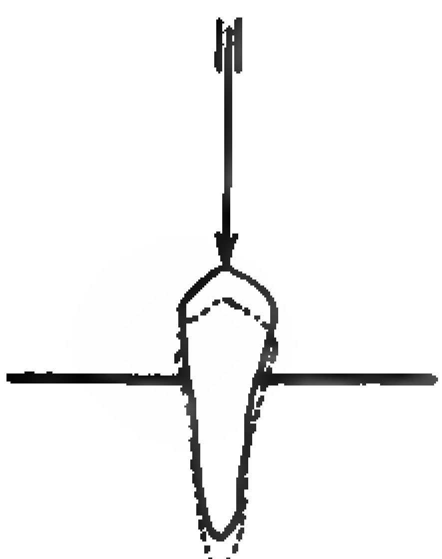


Fig. 2.

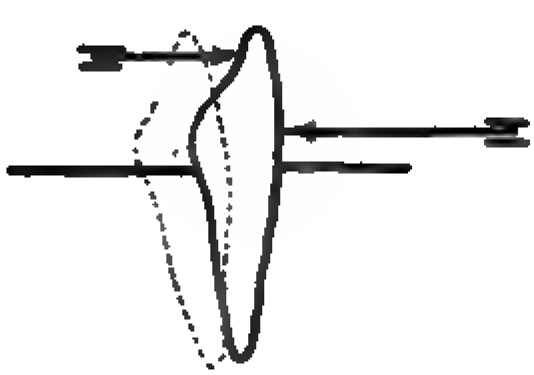


Fig. 3.

Assuming now, that we are familiar with the elements of applied forces and their reaction, it should be evident that the resultant of all applied forces must exceed in magnitude the resultant reaction (resistance), if movement is to take place at all. The resultant of the applied forces is transmitted to the bone at the surface of the root, in fact all around the root, in the case of a commonly malposed tooth. For the sake of simplicity it will be assumed, that the resisting pressure is uniformly distributed on the projected area of the root, that is projected in the direction of movement.

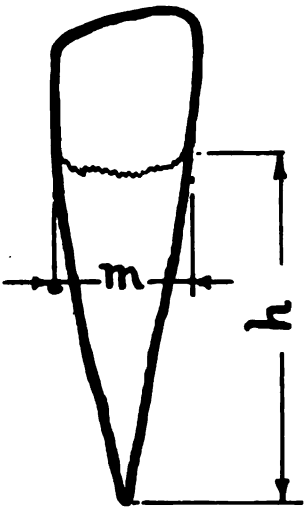


Fig. 4.

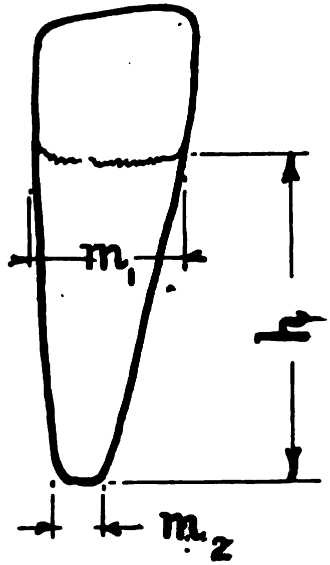


Fig. 5.

Let the width of a tooth at the gum line be m and the length h. Assuming the root to be conical as illustrated in Fig. 4, the projected area is:

$$A = \frac{m\ h}{2} \quad \left(\frac{\text{width} \times \text{length}}{2}\right) \qquad (1)$$

and if we are confronted with a trapeze-like shape of the root (Fig. 5) then the projected area is:

$$A = \frac{(m_1 + m_2)\ h}{2} \quad (\text{average width} \times \text{length}) \qquad (2)$$

The pressure per unit area (intensity of pressure):

$$f = \frac{F}{A} \quad \left(\frac{\text{force}}{\text{area}}\right) \qquad (3)$$

If the tooth has to be moved, the distance D (see Fig. 1) then the work to be performed is:

$$E = F\,D = f\,A\,D \qquad (4)$$
$$(\text{work} = \text{unit pressure} \times \text{projected area} \times \text{distance})$$

since

$$AD = C \qquad (5)$$
$$(\text{projected area} \times \text{distance} = \text{volume})$$

represents the volume of absorbed bone tissue (and also of the regenerated bone tissue), therefore

$$E = fC \qquad (6)$$
$$(\text{work} = \text{unit pressure} \times \text{volume})$$

The minimum potential energy that must be contained within the appliance is equivalent to this work.

From equation 6 we have

$$f = \frac{E}{C} \qquad (7)$$

$$\left(\text{unit pressure} = \frac{\text{work}}{\text{volume}}\right)$$

which also represents the work that is necessary to overcome the resistance of absorption and regeneration of one cubic millimeter of bone. It is probably a constant for certain existing conditions.

Taking into consideration the time within which the movement of the tooth is to be accomplished we arrive at a power equation

$$P = \frac{E}{T} \qquad (8)$$

$$\left(\text{power} = \frac{\text{work}}{\text{time}}\right)$$

since $E = F\ D$ (4)

$$(\text{work} = \text{force} \times \text{distance})$$

therefore $P = F\frac{D}{T}$ (9)

$$\left(\text{power} = \text{force}\frac{\text{distance}}{\text{time}}\right)$$

since $F = f.A$ from (3)

$$(\text{force} = \text{unit pressure} \times \text{area})$$

and $\frac{D}{T} = V$ (10)

$$\left(\frac{\text{distance}}{\text{time}} = \text{velocity}\right)$$

therefore $P = f\ A\ V$ (11)

$$(\text{power} = \text{unit pressure} \times \text{area} \times \text{velocity})$$

We now have an equation for the power necessary to perform an operation which contains the two variable factors f and V, intensity of pressure and velocity of movement, respectively.

Obviously, there exist maximum and minimum values of these factors, within which included regions practice should be confined. It is evident, that very low values, while not harmful, would unnecessarily prolong the duration of treatment. On the other hand, excessively high values are distinctly harmful, and may be the cause of dangerous aggravations.

We will now revert to a brief discussion of the units of measure thus far employed. The units of force, pressure, distance, area and volume are the customary metric units based on the gram and millimeter, and generally employed, in scientific work.

The reasons for the choice of one week as the unit of time, will be obvious. From the units of time and distance we obtain our unit of velocity, v the *millimeter-week,* and will be designated,

$$v = \frac{mm}{w} \qquad (12)$$

The unit of work or energy is that which resists a force of one gram through a distance of one millimeter, and will be designated as *millimeter-gram*

$$w = e = mm\ g \qquad (13)$$

From the above, we obtain the unit of power of our system, the millimeter-gram-week. That is the power required to overcome one gram through one mm. in one week.

For convenience, we will name this unit an "Ant Power" and designate it as

$$1\ AP = \frac{mm\ g}{w} \qquad (14)$$

It may be interesting to note that this unit of power compared with the (metric) horse power is:

$$1\ AP = \frac{1}{45,360,000,000,000}\ HP$$

It is evident that a given force will cause a certain movement in a certain time. After observations of a particular case, in which an appliance is employed, the velocity which gives the best results may be readily determined. Through comparative analysis (diagnosis) of the recorded data of such observations we will soon be able to classify many seemingly perplexing results.

It is highly important to have a clear conception of force, work, energy, and power in order to prepare proper appliances, especially when the correct arch should only be obtained in successive stages.

From the equation of power (8) $P = \frac{E}{T}$

therefore $E = PT$ (work = power × time) (15)

it may be readily perceived for a specific energy required to perform a definite movement the power varies inversely with the duration of the treatment.

In the equation for power (11) we introduce (10) and arrive at

$$P = \frac{f\ A\ D}{T} \qquad (16)$$

m, 1, D, F and T may be measured or estimated, and

$$f = \frac{F}{A} \quad \text{assumed} \qquad (3)$$

We now have all factors of the equation and P may be readily calculated.

For the sake of clearness, we will take a specific case and apply formulas developed above.

Let us now arbitrarily assume that through experiment we have found that an intensity of pressure of $\frac{1}{9}$ g has proved to be a practical value to employ in moving a cuspid lingually at a rate of ½ $\frac{mm.}{w}$ The width of the tooth measures 9 mm., the length of the root, determined by x-ray, 16 mm. and the distance the tooth must be moved bodily equals 3 mm.

$$V = \tfrac{1}{2}\frac{mm}{w} \text{ (assumed)}$$

$$T = \frac{D}{V} \qquad \text{from (10)}$$

$$T = \frac{3}{\tfrac{1}{2}} = 6 \text{ weeks}$$

$$A = \frac{mh}{2} \text{ assuming the root is conical} \qquad (1)$$

$$A = \frac{9 \times 16}{2} = 72 \text{ mm}^2$$

$$f = \frac{1}{9} \text{ g (assumed)}$$

$$F = A\ f\ = 72.\frac{1}{9} = 8 \text{ g} \qquad \text{from (3)}$$

$$P = f\ A \cdot \frac{D}{T} \qquad (16)$$

Since $\frac{D}{T} = V$

and $A = \frac{mh}{2}$

therefore $P = f\,\frac{mh}{2}\,V$

$$P = \frac{1}{9} \quad \frac{9 \times 16}{2} \quad .\tfrac{1}{2}$$

$$P = \frac{1 \times 9 \times 16 \times 1}{9 \times 2 \times 2} = 4 \text{ AP}$$

4 AP is, therefore, the power we should expect to use if conditions were as assumed. The tooth must be moved 3 mm., which means we have to apply this power constantly for 6 weeks to move the tooth as has been calculated. We now come to some practical considerations. Say, after one week disturbances (irration of the gum, loosening of the teeth, etc.) have been observed, we may rationally conclude that we have moved the tooth too "fast," that is, the pressure applied was too great. The obvious step would be to measure the actual distance the tooth has moved. Say we find that it has moved 1.6 mm. in one week instead of ½ mm. as intended. That could only have happened because the actual resistance was less than assumed. For the time being we may reasonably assume that the power employed was proportionately excessive, i. e.,

$$\frac{P}{P_1} = \frac{V}{V_1} = \frac{1.6}{\tfrac{1}{2}} = 3.2 \qquad (17)$$

i.e., $P = 3.2\ P_1$

and instead of 4 AP,

$$P_1 = \frac{P}{3.2} = \frac{4}{3.2} = 1.25 \text{ AP should have been applied.}$$

These calculations are based on the theory that tooth movement is directly proportioned to the pressure applied, an assumption which, although rational, may not be correct. The correct relation can only be determined through sufficient experimental data. It has also been assumed that the force is constant which is not absolutely correct.

Using now

$$P = 1.25\ AP$$

let us retrace our calculations to obtain F_1 the new force that may be applied.

$$P_1 = \frac{F_1 D}{T} \qquad (9)$$

$$P_1 = F_1 V. \qquad (18)$$

$$1.25 = \tfrac{1}{2} F$$

$$F = 1.25 \times 2$$

$$F = 2.5\ g$$

instead of $F = 8$ g, which is the force that acted when we applied a power of 3.2 AP.

If the observed results, after the application of the newly found force, are satisfactory, then we continue the treatment or we complete our treatment in stages, as the case may require. Should, however, unfavorable symptoms persist, then it will be necessary to still further modify conditions, precisely as outlined.

As far as the theoretical mechanics involved is concerned, the subject may be reduced to simple mathematics. The determination of practical constants in the equations will be a matter of many observations of carefully conducted experiments.

The practical application of orthodontic mechanics, the *elements* of which have been outlined, must obviously be preceded by accurate, authoritative determination of the experimental factors which follow.

Velocity of tooth movements.

Intensity of pressure.

Time relation between absorption and regeneration of bone tissue.

Relative resistance of different teeth in a given mouth.

Resistance and action of bone tissue *at different depths.*

The universal application of dental engineering principles in the practice of orthodontia will doubtless bring a new era in this science. I shall not attempt to enumerate the possible advantages. It would obviously be superfluous to present a brief in favor of a rational method as a substitute for no method.

Where structures were once built "not to fall down" they are today built "to stand up." That phrase aptly compares the engineering of today and yesterday. It is hoped that this phrase may soon be applied in speaking of the advancement of orthodontia.

A STUDY OF SOME DENTAL ANOMALIES*

By B. Frank Gray, D.D.S., Colorado Springs, Colo.

THE orthodontist is dealing every day with dental anomalies. I take it any dental irregularity, or peculiarity, for that matter, may properly be called an "anomaly." However, in this paper I wish a restricted meaning to apply to the word "anomaly."

We observe cases where certain teeth are almost wholly transposed in their relative positions. For instance, a cuspid tooth may be much more nearly in the normal position of the lateral incisor, and the lateral more nearly in the normal position of the cuspid, than either tooth may be to its own proper position. What shall we do in treating such cases? I do not believe the "farthest way round is always the nearest way home."

I have in mind a patient I treated two or three years ago, where the maxillary right cuspid was really very near the normal position of the lateral incisor. Likewise, the lateral was approximately in the normal place of the cuspid. I felt more than justified in moving the cuspid tooth to the normal place of the lateral, and the lateral incisor was allowed to occupy the place of the cuspid. But all cuspid teeth do not make good laterals! In the case cited, after reducing the already rather blunt cusp and shaping the tooth a bit with stones, I assure you it looked very well indeed. To have placed those teeth where they really belonged would have entailed a strenuous operation, and its justification in the case of this patient of fourteen years of age would have been most questionable.

I recall an orthodontist showing me models, a few years ago, of a rather similar anomaly. The transposition of the cuspid and lateral was almost complete. Yet he assured me he could, and expected to move the cuspid tooth around the lateral, ploughing through a rather thin strip of process. I confess it seemed almost foolhardy.

The principal question that comes to me with reference to this immediate class of anomalies, is this: May we not make too great a sacrifice in endeavoring to establish normal (normal to the letter, I mean) relations of the teeth in these extreme transpositions? In the absence of the models, I may not be fully understood as to the extreme degree of the transposition of the teeth in the case mentioned.

We are finding more and more, I think, the congenital absence of permanent teeth. I never think of allowing a deciduous tooth to be extracted without a radiographic examination, unless its successor is absolutely assured. The cases multiply wherein the permanent teeth are missing, and certainly a deciduous tooth may be made to do important service for some considerable time in such a case.

I call your attention to the case of a boy of about seven years of age. In the absence of the mandibular second deciduous molar, I made x-ray pictures,

*Read before the Pacific Coast Society of Orthodontists, February 12, 1917.

which revealed there was no second bicuspid. Then I radiographed the opposite side, though the deciduous second molar *was* present. The second bicuspid was also absent on that side. (Fig. 1.) There is one principal point in this case about which I would like to have as many opinions as possible. I advised the parents it would be best to remove the remaining right second deciduous molar, and move forward both first permanent molars the width of the missing bicuspid teeth, believing the second permanent molar would in due course, erupt forward, thus avoiding the necessity of bridge work later on, and, incidentally, removing an obstacle to the normal anterior development of the lower arch,—leastways saving the necessity of a retaining appliance to hold open the space of the missing teeth.

Fig. 1.

Fig. 2.

Fig. 3.

Another case which has interested me is that of a boy twelve or thirteen years of age. You will note by the illustrations (Figs. 2 and 3) that the deciduous cuspids are in place, although the radiographs show their roots are absorbed quite fully. The permanent cuspids are wholly developed and fully erupted. In the congenital absence of both bicuspids on either side, the permanent cuspid occupies approximately the position of the second bicuspid, and it

will be noted the cuspid teeth are almost in contact with the first permanent molar teeth.

On the left side of the mouth the deciduous cuspid is not so fully absorbed as on the right. In the lower arch (Fig. 3) the boy has no second bicuspids. Thus six permanent teeth are congenitally absent.

It would be most interesting, I think, to receive suggestions from the orthodontists, as to the best method of treating such a case, as well as to have their ideas as to methods of supplying the missing teeth.

Fig. 4.

Fig. 5.

Fig. 6.

I wonder how many specialists in orthodontia create dental irregularities? I am sure many of us have some experiences of that sort in the course of our work. In the illustration (Fig. 4) you will note the mandibular second permanent molar has taken a decidedly wrong position. So far as I can guess, it is due to the rather rapid forward movement of the first molar,—the second molar following the channel of least resistance—the furrow ploughed by the forward moving first molar. Note the third molar seems to be taking a somewhat similar inclination.

Again it will be interesting, I think, to consider the practical means for correcting such a malposition, although *prevention* may be of the first importance. Should I be correct as to the cause of the condition shown, then may we not need to be a bit on the alert in this matter? Probably my last suggestion as to the cause, had best been first; i. e., was the erupting second molar retarded by contact with an ill-fitting band on the first molar?

I am still confronted, among dentists, with the contention that third molars exert an unfavorable influence on the occlusion of the teeth in some cases; that although irregularly placed teeth are corrected, the erupting third molars distort the occlusion very seriously. That these teeth do exert a tremendous force on adjoining teeth I think was attested in the case of which I show radiographs (Fig. 5). Because of the serious character of the impactions, the dentist recommended the extraction of the second molars (certain distressing nervous affections having been in evidence). One of the extracted second molars was shown me by the exodontist, and there was pointed out to me by the family dentist, a *decided groove* in the distal surface of the tooth at a point corresponding with the point of contact with the impacted third molar. Beyond any reasonable doubt, in this case the third molar *had* created the latter anomalous condition, and these impacted teeth were the cause of the patient's suffering. After the removal of the second molars, the symptoms complained of by the patient disappeared.

Aside from the possibility of distortion of occlusion, it is, of course, extremely interesting to note and study the series of nerve reflexes due to these impactions. A study of the nerve supply, the ganglia, etc., of course, explains how these conditions may be brought about. Distressing mental ailments are not infrequently caused by such anomalies. Such has been the testimony of the late Dr. Upson, of Cleveland, of Drs. Cryer and Mershon, of Philadelphia, and of a great many others.

Since this paper was read, the case represented in Fig. 6 came under my observation. The patient, a woman of approximately thirty-five years of age, had gone the round of the medical and dental profession, seeking relief from a distressing neuralgia, extending over a long period of time. A radiographic examination revealed the impacted upper first molar, as shown. Doubtless here lies the cause of the persistent neuralgias from which this patient has suffered. The tooth has not yet been removed because a surgical procedure of this importance is not entered into by the average person without some trepidation.

In conclusion, I am impressed more and more with the immense field of interest and profit, in the study of the class of anomalies I have referred to. We cannot, in justice to our patients or ourselves, pass these things by lightly. And until some standard of treatment has been proved quite wholly correct, I feel there is a large field for study, experimentation, and, I trust, an opportunity for benefiting humanity.

DISCUSSION.

Dr. McCoy.—I remember the first case I had in orthodontic practice was one in which there was a transposition of the upper lateral and cuspid on the right side. In the enthusiasm of my youth I unhesitatingly undertook the treatment of this case, and before I got through with it I had some very discouraging times. At the end of nineteen months, however, I succeeded in accomplishing the movement of these two teeth without the death

of the pulp of either of them. In all such cases, if they should come to me now, unless there was some very, very important reason why the positions of those teeth should be changed, I think I would hesitate seriously in doing it, just as I would hesitate to rotate a bicuspid which was completely rotated, as they are sometimes found.

Dr. Gray mentioned the influence of the developing third molars, and their relation to malocclusion of the lower teeth. I think these teeth should be watched very closely at the time when their eruption is going on, and if we will take a little precaution we can prevent any trouble which might result from them. I have made it a rule for several years, in as many cases as possible of this class, when I think it is about time for these teeth to commence to make themselves apparent, to make radiographs, and if I find they are starting upon their journey toward complete eruption I construct a retainer by banding the lower cuspids and connecting them with a lingual wire, and thus give a bit of added support to the lower arch in the belief that I will prevent the third molars from doing any harm. I am sure that the results justify me in going to this extra trouble.

In many cases, at the very first sign of any crowding of the lower incisors, or crowding between the lower cuspids, I have made radiographs, and without a single exception the radiographs have shown the lower third molars in the process of development or eruption, and they do not necessarily have to be impacted either, in order to cause this pressure.

I think in the case of missing lower second bicuspids, that unless there is some unusual condition prevailing, we should by all means consider seriously the dragging of the lower first molar forward and filling the space, and letting the lower second molar erupt and fill up the remaining space, and depend on the third molars to make up this deficiency, rather than subject the patient to bridge work for a lifetime. It is a matter of debate, but I think I would personally rather have one less tooth if I could have the molars in good contact with the lower first bicuspid, and depend on the teeth posterior to make up for the deficient grinding surface rather than be subjected to bridgework.

Dr. Suggett.—I find I am drifting into the same state of mind as Dr. Gray and Dr. McCoy in those cases. I used to unhesitatingly open up the spaces for missing laterals and bicuspids, but in the last few years, since hearing some of our best operators express their opinion that their best root canal work has often proved a failure, and they realize they have to cut down teeth for bridge work, I hesitate to bridge in those spaces. In several cases referred to me from the East, I have found the men there are doing the same thing—beginning to close up the spaces where they used to open them up. Since the x-ray has come into such general use, some of the best root canal work in a few years shows up very badly, and most of the best operators are having less faith in the permanence of that work than they had before, so it behooves us to side-step bridge work every time we have an opportunity to do so. It is easier to bring those teeth forward since we have the new form of attachments than it was before. Now, with these direct attachments we can slowly close up most of those spaces very nicely, and we have a more healthy mouth through this method. The mother of one of my patients has as beautiful an arch—at conversational distance—as you could imagine, and both laterals are missing. The cuspids are moved forward, and the effect appears as perfect, as far as shape of the arch is concerned, as most any case one could see. I have seen a number of others that have done the same way, and I have tried to pattern after that in some later cases, with fairly good success.

Dr. Ketcham.—In regard to the last films Dr. Gray showed on the screen—x-rays of temporary teeth about to be shed (lower temporary molars with the cusps holding the space open), the second temporary molar was lost through decay several years before it should have been lost. In this boy the masticating efficiency of his teeth was greatly reduced: the patient was poorly nourished, etc. The object of putting the cusp on was to get occlusion with the upper teeth—masticating efficiency for that side of his mouth. To the anchorage band on the molar was attached a loop upon the mesial surface of the band. The first temporary molar was banded, then a cusp struck up to fill the space between the first temporary molar and the first permanent molar, and the cusp was soldered directly to the first temporary molar band, and toward the posterior end of the cusp on the under portion, was soldered a spur resting in the loop upon the molar band, permitting of the movement of the anchorage tooth, and it gave the boy occlusion. The space would have been held by the arch wire, but with the improved masticating efficiency of his teeth, the spreading of his arches and improved breathing, he made a marked gain in health.

The question where a premolar is absent, of whether to permit the space to close

(and the lower second premolar is the tooth most commonly absent in my experience) is important. I think an orthodontist who does not systematically check up by means of the x-ray, every temporary tooth in the mouth when a patient comes to him—unless he can feel or see the succeeding tooth—is guilty of gross carelessness, because there is about one child out of ten, in my experience, in whom one or more of the permanent teeth are absent. So it is not unusual in checking up these children, to find that some of the permanent teeth are absent, and we should know that when we start treatment of the case so all measures should be taken to save those temporary teeth—as they should not be lost under such circumstances.

The question of permitting the space to close is really a grave question. We know if we permit the space to close and the antagonizing teeth are all present, we will have malocclusion of the grinding surfaces of those teeth, and we will have a greatly reduced efficiency of mastication of food. I reported a case some years ago of subdivision of Division 2 of Class II. A lower lateral was extracted because it erupted lingual to normal. I first started to make space for the missing lateral, and I was moving the lower teeth on the right side, forward as well. It occurred to me, why not move all the teeth on that side forward further than normal the width of one cusp. So I did that and closed the space. I moved everything around toward the left until the right lower bicuspid occupied the space which the cuspid had formerly occupied, and the cuspid was in the space of the lateral. I left the molars too far forward the width of a cusp in relation to the upper molars. A study of the patient's face when I started treatment, showed the muscles on the left side of his face were better developed than the muscles on the right side of the face, where the molars were in distal occlusion. Immediately after treating, no noticeable difference between the two sides of the face was in evidence. In two, five and ten years after treatment the muscles on the left side of the face showed better development than upon the right. The patient is trying to use both sides of his mouth in the mastication of food, but the left side is much better than the right side. The teeth have settled so that the interdigitation of the cusps is as perfect as possible in such a case. The cusps are long and well locked. But you can see the efficiency is so reduced that really it is a serious question what to do in these cases—whether to let the patient have bridges later on in life, or close up the spaces, with the resulting poor mastication of food.

Dr. Dewey.—The question of treating cases where teeth are missing—termed "compromise treatment" by Lourie, is something to which we should pay more attention. In the case described by Dr. Ketcham, I wonder if it was a question of inefficiency or a question of habit as to the mastication? If you study anatomical forms of the teeth. there is a difference between a lower first and lower second molar, and you do not get an anatomical occlusion by moving the first molar forward; but I think it is better than resorting to an artificial tooth. The occlusion finally becomes worn by masticating stress, and you have a more efficient apparatus than by any artificial substitute.

Another thing I have observed is, in those cases where the first molar is moved forward and the second follows it, they almost invariably have a large lower third molar. Whether it would have been large anyway, is a question. The third molar on the side of the missing tooth is always the larger. It seems at first glance, one would explain the question of the growth of the third molar to a larger size, by the absence of a tooth on that side. The calcification of the third molar is delayed very much. There is calcification of the crown, but not a fusing together of those cusps. Until those cusps become fused together it is possible for the crown to become increased in size.

As stated before, I have observed in a number of cases that the third molars are larger on the side of the missing tooth. However, there is no way of proving it would not have been larger if the tooth had not been missing.

In the treatment of transposed teeth, such as the shifting of the canines and laterals, I think if the canine takes the position where the lateral should be, the best thing to do is to leave it there and not try to shift it, because the long treatment required to move this tooth entirely around, is very liable to subject the patient to nervous shock, the result of which we do not know; and in reality we are working for the benefit of our patient more than we are for ideal results.

Regarding the case shown by Dr. Gray, where the second molar was tipped forward —as well as the tipping of third molars—some of you may remember about two years ago we published a paper by Lourie on the treatment of such cases, in which he had used "the ligature jack." He has a number of results where he has straightened up apparently

hopeless third molars, thus avoiding their extraction, etc. The principle of the ligature jack is very beautiful, because of the small amount of force it exerts and the ideal position in which that force is applied. Mitchell, of Indianapolis, has applied it to the expansion of the arch—using the ligature jack in the canine region—with very decided results. It works beautifully. In these cases of missing teeth I think we should treat them from the standpoint of efficiency rather than from the standpoint of the ideal results.

Dr. Solley.—I have a case on hand at present that has demanded considerable thought. The two lower centrals and the upper right lateral are missing. The question is whether to draw the lower lateral incisors over to the center and swing in cuspids, or whether or not I will get sufficient strength from the lower laterals to swing a slight bridge in there. Am I right in drawing the two lower laterals to the center to get additional strength for the bridge work?

Dr. Dunn.—I have always taken the stand that it is far better to close all spaces in the case of missing teeth, than to supply the teeth by artificial means—wherever it is possible to make the necessary tooth movements. Because of that stand I have had quite a number of experiences. Some have proved rather sad, and others have been very gratifying. I found, of course, in moving the first molar into the space of the second premolar—the ease of the operation depended largely on whether the movement was in the upper or lower arch—much more skill being required to move the lower first molar forward than the upper first molar. My first experience was with a patient where I needed to move the second molar forward to take the place of the first molar—lost by extraction. That experience was not very gratifying. I carried them part way. The final result I am not able to state at this time. I have now a patient—a boy who was originally a patient of Hawley, of Washington—where the results of carrying the second molars forward was very good indeed, and the work was quite easy of accomplishment, even though there was little cooperation on the part of the patient. I have another patient—a girl of twelve years of age—where if I had it to do over again, I certainly would not undertake it. I have finally carried the second molars forward, but it has now covered a period of two years to accomplish that movement, and I doubt if I was warranted in expending that amount of energy and time on such a piece of work.

As to moving teeth into spaces where a number of teeth are missing, thus trying to fill those spaces, I believe it to be wholly inadvisable. I have had several cases of that kind, and perhaps due to a lack of cooperation of the patient the time spent has been extended, and the result has not been satisfactory. I think it would be much better to supply those spaces by artificial means.

I have also had the experience of moving cuspids around laterals, one in particular I recall, which caused me to reach the same decision as Dr. McCoy—"Never again!" I think those movements are a mistake, and that we should never attempt to do such things.

As to the tipping of the teeth, of which Dr. Gray has spoken, I believe in the treatment of Class III cases, in the lower—if we are not especially careful we will impact the second or third molars. Where the teeth are not erupted I think that is commonly done. The occluding surface of the impacted molar lies up against the distal surface of the tooth immediately in front of it. In Class II cases where we hurry our treatment I think many times the second or third molars are impacted as stated. The force is too great against the anchor tooth—carrying it distally. As to the case Dr. Gray cites, where he believes the dragging of the first molar forward rapidly caused the tipping of the second molar, I, too, believe the too rapid movement was the cause, the second molar not having an opportunity to right itself.

I have a case of my own at the present time (it really should come under Class I, but it might have come under a Subdivision of Division 2, Class II) where the right first molar was moved distally to make room for the second premolar. In that movement the second molar was forced lingually, in toward the tongue. The result has been I have had a most difficult time because the relation of the third molar had to be overcome. The extraction of the third molar is impossible at this time.

Dr. Gray.—I am much gratified at the discussion of these subjects by so many of the members. While I will not occupy further time, I wish to say I regard the points brought out as being of great practical worth. The experience of orthodontists who have struggled with these problems for years, is certainly worthy of careful consideration. Almost any tooth movement is possible with our knowledge and skill at this time—but there are some tooth movements which may be wholly unfair to our patients.

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

JAMES DAVID McCOY, D.D.S., EDITOR
LOS ANGELES, CALIF.

THE DENTAL RADIOGRAM—ITS VALUE, ITS ABUSE, AND SOME POINTS IN ITS INTERPRETATION*

BY LELAND E. CARTER, D.D.S., SAN FRANCISCO, CALIF.

IN offering this paper, I do not wish to convey the impression that I claim a superior knowledge of the science of dental radiography, and I sincerely hope that any statements I may make will not be considered an attempt to arraign the profession of which I have the honor of being a member. My conclusions in relation to dental radiography are the result of considerable thought, study, and practical experience in this particular line of work, and I offer them in the hope that I may contribute a share toward a better general understanding of the possibilities and limitations of the x-ray as applied to dental surgery. My object is not only to impress upon you the value of this particular diagnostic aid, and point out to you the opportunities we are overlooking by neglecting to give it the attention it deserves, but also to call attention to the abuse to which it has been subjected, and by explaining some of the elementary points in the interpretation of radiograms, prove the utter impossibility of taking full advantage of dental radiography under existing conditions.

There seems to be a great difference of opinion among writers and speakers on the subject as to the terminology which should be used when mentioning that phenomenon in physics commonly called the "x-ray." As William Conrad Roentgen was responsible for this most wonderful contribution to science, and whereas it is most desirable that a standard nomenclature be adopted, the use of his name when referring to his discovery has been suggested as a most fitting and commendable practice. Our own Horace Wells discovered anesthesia, but we do not call it "Wellsology," so I can not see why we should make an exception relative to the x-ray. Professor Roentgen called his discovery the x-ray because he did not know exactly what he had discovered and inasmuch as there still exists a doubt as to the exact nature of this phenomenon, why not continue to call it the x-ray? Aside from the fact that it is the modern tendency to do away with the discoverer's name in the construction of the terminology applicable to a scientific discovery, *roentgenology* is a difficult name to pronounce. Radiogram is without doubt the logical word when referring to an x-ray negative. It is derived from the combination of a Latin and Greek word meaning *ray*, and *that which is written*. So we have radiogram,—that which

*Read before the Alumni Society of the Dewey School of Orthodontia, Chicago, Ill., March, 1917.

is written with the ray. And so by the science of word building we have constructed a nomenclature as follows, in part:

X-ray:—A phenomenon in physics discovered by William Conrad Roentgen.
Radiogram:—The shadow picture written with the x-ray.
Radiograph:—(A verb.) To make a radiogram.
Radiography:—The practice of producing the radiogram.

For our own use we simply prefix the word *dental.*

Raper has constructed the word *radiodontia,* which answers our purpose even better than anything offered before. We have our *orthodontia* and several other *dontias,* so there is no reason why we should not use the word radiodontia.

For the benefit of those who may not be familiar with the terminology sanctioned by the American Roentgen Ray Society, I have here added their nomenclature:

Roentgen:—Pronounced rent-gen.
Roentgen ray:—A phenomenon in physics discovered by William Conrad Roentgen.
Roentgenology:—The study and practice of the Roentgen ray as it applies to medicine and surgery.
Roentgenogram:—The shadow picture produced by the roentgen ray on a sensitized plate or film.
Roentgenograph:—(A verb.) To make a roentgenogram.

Just imagine bouncing those words off your tongue for half an hour!

To mention the many cases in which dental radiography can be used to advantage in a modern dental practice would simply be a resume of nearly the entire list of dental operations. I do not believe the radiogram is infallible, but I am firmly convinced that if the possibilities of the x-ray, as applied to dentistry, are carefully studied and scientifically employed, dental surgery will advance more rapidly and gain recognition more quickly than could be made possible by any other means. Aside from its value as an efficient aid in all classes of professional work, it has been a potent factor in raising our professional horizon; it is probably one of the strongest links between the dental and the medical professions, and if properly taken advantage of, will do a great deal toward bringing about a more intimate relationship between the two professions, the ultimate realization of which would be a great benefit to humanity. It is not an uncommon thing to find the physician referring his patient to a dental surgeon for a complete examination of the oral cavity. The progressive internist is beginning to realize that he must call upon the dental profession more frequently for help in combating many of the ills to which the human body is heir. The wide-awake dental practitioner sees in this practice the dawn of a new era in his profession and is preparing himself to meet the new conditions.

There is no doubt that the pulpless tooth problem is one of the most serious with which the dental profession has ever been confronted. Its solution would undoubtedly fulfill the prediction made by an eminent member of the medical profession, that the next great step in preventative medicine would come from the dental profession. How soon this prediction will be carried into effect is

hard to conjecture, but—*when it is, the x-ray will be found intimately associated with the means of its accomplishment.*

Recent discoveries have furnished abundant and sufficient proof to show that our indifference to science has been our greatest stumbling block. As a profession we have given too much time to art and not enough to the scientific side of our calling. Heretofore most of the progress in dentistry has been on a mechanical plane, and while our advance in this respect is worthy of great commendation, our very concentration on this phase of our work has made it more difficult for us to rise to the demands now being made upon us. For some time past we have been educating the school children in oral hygiene and we must take into consideration that before long we will have a more enlightened public to deal with. It would indeed be very embarrassing to find ourselves struggling to answer some of the questions the children of the present are going to ask us in the future. My observation has taught me that the majority of the dental profession are ever ready to avail themselves of any means to improve their service, but they are interested in inverse ratio to the amount of midnight oil which must be burned in order to master its successful application.

The truth of this statement is evidenced by the fact that almost anyone in or out of the dental profession who has evolved an elaborate technic covering any branch of our work, finds little difficulty in persuading many dental practitioners to accept his methods: we are prone to jump to the conclusion that these *educators* have worked out the scientific factors governing their particular line of work, when, as a matter of fact, they have, in many instances, simply jumped to conclusions themselves.

Many instances could be cited to show that we are prone to jump to conclusions, but I shall not take time to mention them in this paper. I have simply digressed for a moment from my subject in order that I might bring to your attention more forcibly the fact that we must become thinkers if we wish to keep abreast of the times. We must discourage the habit of jumping to conclusions and demand that these self-appointed educators teach us some good sound science instead of simply giving us an exhibition of their technic.

Following the rather confused condition in which the dental profession found itself when the relationship between foci of infection in the oral cavity and certain systemic diseases was finally accepted as a fact, radiography was introduced as the possible means of solving our problems. We again jumped to a conclusion and the burden was placed on the x-ray. Laymen who were quick to see the commercial possibilities of its rather spectacular features—in the absence of a law governing its application—entered our profession as specialists, after a few weeks' preparation, and offered us all the advantages of the x-ray without the necessity of burdening ourselves with the multiplicity of complications attending its successful application. It is a lamentable fact that with as valuable a diagnostic aid as the x-ray at our disposal, we relegated its application to nonprofessional men who were not prepared to realize the responsibility of the position into which they had thrust themselves. Having obtained a smattering of anatomy and pathology, they attempted to diagnose our cases. We were told that a dark area at the apex of a tooth or anywhere in the radiogram was

an abscess, a granuloma, a cyst or anything that happened to look like a similar case in their textbook. Histories, clinical examinations, or other means of diagnosis were not taken into consideration because these untrained operators were not qualified to intelligently handle or comprehend the necessity of resorting to other diagnostic means, and the majority of dental practitioners, being totally unfamiliar with radiographic technic, were led to believe that the radiogram was infallible. As a result of this invasion of our profession by these untrained laymen who became dental radiographers and diagnosticians virtually over night, thousands of teeth were needlessly sacrificed, sometimes even against the advice of the dental surgeon. Whether we have done more harm than good by this wholesale extraction of teeth is a matter for argument, but the fact still remains that we jumped to a conclusion relative to the application of the x-ray, and we have been, and still are, jumping to conclusions in our interpretations of radiograms.

Another disagreeable feature connected with the present status of dental radiography is the fact that these lay operators not only produce and interpret radiograms for the dental profession, but they perform the same services for the medical profession. I made the statement a few moments since that the x-ray was probably one of the strongest links between the dental and the medical professions, and if properly taken advantage of, would do a great deal toward bringing about a more intimate relationship between the two professions. The practice of allowing the physician to be advised by unqualified dental diagnosticians results in a misunderstanding between the two professions, and tends to separate them rather than to bring about a closer relationship. The internist wishing to determine whether or not there are foci of infection in the oral cavity sends his patient to a dental radiographer and receives a beautiful set of radiograms in due time, showing several so-called *"rarefied areas,"* and a diagnosis of the case. The physician, being unfamiliar with the pathology of the oral cavity and the interpretation of dental radiograms, takes the dental radiographer's diagnosis to be correct and orders the teeth extracted.

Untrained and unethical laymen have done a great deal of harm by insisting upon placing themselves on a level—or above—the dental practitioner in the matter of diagnosis of dental conditions. The fact that these men obtain business from the physician, as well as the dental surgeon, is sufficient to warrant our giving this problem our serious consideration. If members of the medical profession are to be advised relative to oral conditions, this advice should come from a dental surgeon and not from someone who knows less about the oral cavity than the physician himself. We have trouble enough without having some misinformed internist blaming us for an infection which never existed.

Many medical men admit that they are not capable of diagnosing dental diseases and the medical radiologist, as a rule, does not solicit patients from the dental profession, as he claims that he can not give as satisfactory a service as one specially trained in dental science.

Having had no experience in dental practice, but having been placed upon the plane of a professional man by their patients, many laymen can not resist the temptation to pose as specialists, with a knowledge above the ordinary, and

advise the patients as to what should be done to "*cure*" the condition they have so "*miraculously*" discovered. The dental surgeon can not always agree with the findings of the so-called specialist, and as a consequence is given the *credit* by his patient of not knowing his business.

The ability to interpret a dental radiogram is an accomplishment worthy of our serious thought. There is no royal road to success in this particular line of work. To acquire proficiency requires as strict attention to detail as obtains in other departments of dental surgery. One must have a thorough knowledge of the topographical and internal anatomy of the head, a thorough understanding of the technic of producing the radiogram and be familiar with the radiographic appearance of the parts involved under normal conditions.

It is not safe to assume that a radiogram will show a pathological condition. It merely shows a deviation from the normal which may be of pathological or physiological origin. We should never hazard a diagnosis from radiographic findings alone, but should supplement them by other diagnostic means. We can not determine from a radiogram the specific contents of a cavity or resorbed area. It is impossible to differentiate between the pulp, pus, cotton or air in a root canal, so unless the root canal is filled with some substance opaque to the rays, we are unable to determine from x-ray evidence whether or not the tooth is vital. Likewise, a dark area at the apex of a tooth can not be positively diagnosed an abscess, even if it is markedly circumscribed. It may be one of several pathological conditions, the true nature of which we can not determine from the radiogram. The x-ray is distinctly a diagnostic aid, and, when used as such, is capable of being of great assistance to us; but if allowed to be regarded as a positive means of diagnosis, is liable to do much harm.

Before saying more about interpretation I wish to show an old familiar picture (Fig. 1) and call attention particularly to the cancellated structure, the mandibular canal, and the mental foramen. It is well to keep this picture in mind when interpreting a radiogram of this region. You will notice there is no regularity in the cancellated tissue, large and small medullary spaces are scattered here and there and are of all sizes and shapes. It is possible to mistake one of these large medullary spaces for a so-called "rarefied area." The mandibular canal passes downward and forward from the mandibular foramen; its course is near the outer cortical portion and along the lower border of the cancellated tissue passing beneath the foramen to its termination near the roots of the incisor teeth. The mental foramen is the outlet of a branch tube given off slightly anterior to and passing backward to the foramen. This is almost invariably the rule and is shown in this slide. The fact that the tube to the mental foramen is in the form of a recurrent canal often leads those not familiar with this fact to a wrong conclusion relative to the shadow cast in a radiogram.

We must always bear in mind that the radiogram is not a photograph. It is simply a shadowgraphic representation of the varying resistance offered to the x-ray. Different tissues, metallic fillings and the like are represented by a characteristic shadow, governed by the resistance they offer; the less resistance, the darker the shadow.

In the next illustration (Fig. 2) we have metallic fillings, cement and gutta percha showing white. The next darker shade is represented by the enamel.

Then we find the shadow getting still darker as the resistance becomes less, as represented by the roots of the teeth. Next comes the bone, represented by the varying shadows according to its thickness. The white line which borders the roots is the alveolar wall and the dark line between it and the tooth is the peridental membrane. The pulp itself, offering no appreciable resistance, is

Fig. 1. (After Cryer)

Fig. 2.

Fig. 3.

Fig. 4. (After Cryer.)

not shown, but the canal is outlined by a dark shadow. Absence of tissue is charactèrized by a very dark shadow. It is well to keep in mind the dark line and the white line bordering the roots of the teeth. If there is a dark area at the apex of a tooth and these lines are not broken but show distinctly, we have good reason to believe that the apex is not involved.

Fig. 3 illustrates a radiogram of the inferior molars and premolars. It is

a good example of the different degrees of resistance offered to the ray on account of the varying thickness of this particular bone, the mandible, and shows a large area between the first and second premolars—the mental foramen. Incidentally, this slide shows deposits of serumnal calculus at the gingival border.

Fig. 4 (from Cryer) shows sections made at different points from a mandible which was not quite normal in its density. A radiogram of such a mandible would be particularly hard to interpret.

One of the most perplexing features with which we have to deal in the interpretation of radiograms, is the superimposition of shadows. This makes a

Fig. 5. (After Cryer)

Fig. 6. (After Cryer)

Fig 7 (After Cryer.)

Fig. 8. (After Cryer.)

negative of the area involving the superior molars exceedingly difficult to interpret on account of the superimposed shadow of the antrum.

Fig. 5 (from Cryer) showing a transverse section of a typical skull, illustrates the position of the first molar in relation to the antrum. The fact that we meet so many variations in the size and the shape of antrum and nasal cavity increases the difficulty of obtaining satisfactory results in these particular regions.

Fig. 6 (from Cryer) shows lack of symmetry in the nasal and maxillary sinuses. It is always necessary to make several exposures of this area as it is almost impossible to make one exposure giving the correct root lengths. As

the buccal roots are superimposed over the lingual roots, we must vary the angle.

Fig. 7 is an illustration taken from the under surface of a typical skull. The prominence of the zygoma makes the molars difficult to radiograph in this type of head on account of the superimposed shadows. The type shown in Fig. 8 is very different in all respects.

It is not generally understood that a radiogram of the superior incisors is one of the most difficult to interpret with which we have to deal. The radiogram shown on the next slide (Fig. 9) emphasizes the fact that a diagnosis should never be made from radiographic findings alone. Here we have apparently a large circumscribed area involving the superior central incisors. The patient's turbinate bones had been removed some time previous to the radiographic examination. The six anterior teeth responded to the electric test. Percussion and transillumination gave no evidence of the existence of an area as shown in the radiogram. A wire placed upon the nose at the junction of the nasal cartilage

Fig. 9.

Fig. 10.

and the inferior border of the nasal bones outlines the posterior border of the shadow as shown on the radiogram. The position of the film and the direction of the rays are shown in Fig. 10. With this description I will leave the case in your hands.

The title of this paper covering three important phases of dental radiography —any one of which is worthy of a separate discussion—precludes dealing with them all in detail except in a very lengthy paper. I have simply mentioned some of the important points in the three phases, as I view them. If I have succeeded in bringing to your attention some new points which will be of value to you, I feel greatly gratified and fully compensated for the time given to the preparation of this paper.

METHOD FOR DENTAL STEREOROENTGENOGRAPHY*

By Henri Letord, D.D.S., and Charles G. Lunan, El Paso, Texas.

DENTAL roentgenography has generally been confined to the use of single roentgenograms as in multiple films or x-ray plates. Until recently the writers have been accustomed to making plate records of the upper and lower jaws, supplementing these, when necessary, by dental film records. No argument is necessary to convince one that the stereoroentgenogram is superior to a single plate in clearing up doubtful points.

Using as a model the old type of "frontal sinus" board, we had built a duplicate with a shallow tunnel underneath to accommodate a 6½ by 8½ inch plate. (Figs. 1 and 2.) These illustrations show more plainly than any written description the groove where the plate is inserted and the rectangle marked on the surface directly overlying the plate. Care is taken to shake the plates into similar positions in the envelope before inserting them.

The surface of the board measures 15½ inches in length and 11 inches in width. The thickness is 1¼ inches. The bark piece measures 11 inches by 3½ inches. The total length of the slot measures 7¼ inches, and begins 2 inches from the back of the instrument. There is a notch on the under surface to make it easy to withdraw the plates. The slot is one quarter of an inch in width.

We employ a tube stand of the Kelly model. Any good tube stand will answer, provided it permits easy manipulation of the tube carriage for stereoroentgenography.

The technic is very simple: First, make an exposure; second, change the exposed plate for a second plate, move the tube 2½ inches, and continue with the second exposure. It is important to see that the long edge of the rectangle, indicating position of plate, is parallel to the long supporting bars of the tube stand.

*Reprinted from the *American Journal of Roentgenology*, June, 1917.

The International Journal of Orthodontia

PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 801-807 Metropolitan Bldg., St. Louis, Mo.

Foreign Depots—*Great Britain*—Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

Subscription Rates—Single Copies, 30 cents. To anywhere in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $3.00 per year in advance. Under foreign postage, $3.40. English price: 15/ per annum, 1/6 per number. Volume begins with January and ends with December of each year.

Remittances—Remittances for subscriptions should be made by check, draft, postoffice or express money order, or registered letter, payable to the publishers, The C. V. Mosby Company.

Contributions—The editor will be pleased to consider the publication of original communications of merit on orthodontic and allied subjects, which must be contributed solely to this journal.

Opinions—Neither the editor nor the publisher hold themselves responsible for the opinions of contributors, nor are they responsible for other than editorial statements.

Reprints—Since it is not desirable to hold type standing longer than absolutely necessary, all requests for reprints should be made at time of submitting manuscript for publication. Rate card will be sent with galley proof.

Communications—Contributed articles, illustrations, letters, books for review, and all other matter pertaining to the editorial department should be addressed to the Editor, Doctor Martin Dewey, 25 East Washington Street, Chicago, Ill. All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 801-807 Metropolitan Building, St. Louis, Mo.

Illustrations—Such halftones and zinc etchings as in the judgment of the editor are necessary to illustrate articles will be furnished when photographs or drawings are supplied by the authors of said articles.

Advertisements—Objectionable advertisements will not be accepted for publication in this journal. Forms close first of month preceding date of issue. Advertising rates and sizes on application.

Change of Address—The publishers should be advised of change of subscriber's address about fifteen days before date of issue, with both new and old addresses given.

Nonreceipt of Copies—Complaints for nonreceipt of copies or requests for extra numbers must be received on or before the fifteenth of the month of publication; otherwise the supply is apt to be exhausted.

Entered at the Post Office at St. Louis, Mo., as Second-Class Matter

EDITORIALS

The System of Trade Journals

THE efforts that are being made by various men in the dental profession at the present time to give dentistry dental literature that is not controlled by dental supply houses has led some men to claim that the fight is being made against dental editors and not against trade journalism. This is not true, as the fight is not with dental editors, but with the system under which they work. We are personally acquainted with the majority of dental editors, and know them to be men of high ideals. They have done a great good for dentistry, but we claim they could have done a greater good if they had worked under another system. There has probably been no force or influence brought to bear directly upon the editors of trade dental journals, for the dental supply houses have been too wise to attempt anything like that, nevertheless, the editor must understand the workings of the trade journal, the principles for which it was founded, and that his influence will be

limited. Anyone versed with the workings of the commercial ideas of the trade journals and the houses which publish them must know that when there has been a conflict of interests between the commercial side of the journal and the professional side, the editor who is working for the commercial house has been subservient to the system, and if he could not endorse the proposition, he has at least kept still. We believe that the editors who are employed by the system are men with high ideals and have done a great amount of good; but we also believe that they could have done a greater amount of good if they had not been employed by the system. If these editors had been working for a journal controlled by the profession, or by themselves, we believe they would have accomplished a greater amount of good for dentistry than they have. Their limits have not been their lack of ability, but the fault of their surroundings.

We often pride ourselves that American dentistry is of the highest type. This may be true in regard to some of the mechanical phases of dentistry, but as related to the dental journals, it is not true. Compare the leading trade journals of America today with the *British Dental Journal.* The *British Dental Journal* is the dental journal of the British Dental Association and it is far superior to any trade journal in existence in this country. The journal is published bimonthly and has a professional standing and dignity that is not possessed by anything published by trade houses in this country. We do not claim that the editorial staff of the *British Dental Journal* is any more capable than is the editorial staff of some of the trade journals of this country, but we do know that they are working in a more professional atmosphere and as a result of it they are able to produce a journal which is far superior to anything produced by the system in this country. The *British Dental Journal,* being conducted in the interest of the profession, contains articles which are of interest to the dental profession.

Often in the case of trade journals, we find that papers describing articles sold by the publishers are given preference over strictly scientific papers. Trade journals will publish papers which are purely scientific, but that they do not give scientific papers the same prominence that they give to commercial papers can be proved by going through the back files of any trade journal. Papers which deal with the commercial side of dentistry are given a more prominent place in trade journals and are better illustrated than are articles which are purely scientific. In going through the back files of one of the prominent trade journals which is published by a house given to the manufacturing of dental appliances, including regulating appliances, we need only to select two papers. One of the papers was a scientific essay which dealt with certain etiological factors of malocclusion. The paper was not given as prominent a place in the journal as it deserved and the illustrations were poorly made. It may have been only an accident, as we know all papers can not be given a prominent place in the journal; however, the same journal published a paper describing a regulating appliance which was manufactured by the dental house publishing the journal, and the paper was placed in a promiment position in the journal and the illustrations were beautifully made. Perhaps this was an accident too; however, we will follow the workings of the system of trade journals further. This paper describing this particular regulating appliance was mentioned in the advertising pages of the journal in the same issue. This may have been another accident. Later this paper was published as a re-

print and sent broadcast to the profession with a price list of the particular appliance. Another accident perhaps, but we believe it was the working of the system. Did they make reprints of the purely scientific paper dealing with important etiological factors in the production of malocclusion and send it broadcast to the profession in the interest of dentistry? They did ***not***. The system does not work that way.

We realize that with large trade journals, they probably have more papers than they can publish, but it is, nevertheless, queer that the papers which deal with scientific subjects should be the ones most often refused space in the journal. That such papers are refused space is proved by the fact that we have published within the last two years two papers which have been in the hands of an editor of a trade journal and they were not published. The refusal of the publication of these papers, or at least the holding of them so long that the authors recalled them, again shows the slowness with which trade journals conclude to publish papers that do not assist the commercial side of their business. These papers to which we refer were part of the proceedings of a certain orthodontic society which had published, and which still publishes, its transactions in the above mentioned trade journal. Rather, they publish such parts of the transactions as the trade journal sees fit to publish. However, the society must like that kind of treatment from the system, for it has again given the transactions to the trade journal. If a journal publishes the transactions of a society, we do not believe it is the duty of the editor of the trade journal to select such essays as he likes and publish them and refuse to publish the remainder. It is almost unbelievable the amount of assumption of authority which some societies will endure at the hands of the system.

We believe that the majority of dental societies are made up of men who have high ideals. However, they often allow their ideals to suffer as the result of the working of the system as was the case in the society referred to. The society, as a whole, probably does not realize to what an extent it is playing into the hands of the system by allowing the trade journal to take liberties with its proceedings and transactions, beside assisting the trade house to carry on its commercial enterprises. We have referred to a certain trade journal, which is published by a dental trade house which manufactures a certain regulating appliance, and which has commercialized the essays published in the journal by referring to the essay in the advertisements and later, by mailing the essay to the dental profession accompanied by a price list of the appliance described in the essay, as being the working of the system of commercialism. We have mentioned that this same commercial journal has been the official organ of a certain orthodontic society and that only such papers as met with the entire approval of the system were published, which plan we claim is not to the greatest good of the science of orthodontia.

Also, we claim that this particular orthodontic society is placing itself unconsciously in the hands of the system by this plan and producing a chain of circumstances which are difficult to explain to a scientific group of men who are not versed with the powers of commercial journalism. For instance, the commercial journal has featured and made an advertisement out of an essay which described a certain regulating appliance, patented by a certain man; the orthodontic so-

ciety is composed of men who are graduates of a school which was founded by the same man who patented the regulating appliance; in other words, the system manufactured the appliance, used the pages of the journal to advertise the patented appliance, and published the transactions of the society which is composed of men who are graduates of the school which bears the same name as the commercial appliance. Not a very pleasing professional and scientific combination. We believe the society is in bad company.

We do not believe that any undue influence has been brought to bear upon the members of the society, for we know most of them personally; but they have unconsciously fallen into the hands of a commercial system and are allowing the transactions of their society to further the interests of a commercial house. We are only mentioning these things to show what a wonderful hold commercial journalism has on the dental profession and how dental societies seem to be entirely subservient to the wish of the system.

The medical profession had a similar fight with trade journalism a few years ago, and has made great strides since the elimination of journals published by supply houses, leaving only those controlled by societies and professional men, published by publishing houses whose business it is to disseminate scientific knowledge and not to sell drugs and surgical supplies. How long will the dental profession play into the hands of the system of commercial journalism?

A Need for the Regulation of Specialists

A FEW years ago when the dental profession was not divided into specialists and the general dentist was supposed to fill all the needs found in the dental field, the question of the regulation of the various specialties was not even considered or even thought of. With the advent of men who began to specialize in orthodontia and a little later those who began specializing in oral prophylaxis and the treatment of pyorrhea, some began to realize that it would be only a few years until the dental profession would be divided up into a number of specialties. That this realization has come true is shown by the fact that we now have a number of distinct specialties in the dental profession. As the public is beginning to recognize these specialties, there is need for some legislative action to control specialization.

The first thing to decide is who has the privilege of specializing in certain subjects. In other words, the question might be asked, "What constitutes a specialist?" From the medico-legal aspect the specialist can be considered a man who shows particular skill in his particular work; one who possesses more than the average ability, and one who is expected to accomplish results which are beyond the average. While this is true of a number of men posing as specialists, of a large number it is not true. Unfortunately at the present time the public has very little means of knowing who is qualified to treat certain conditions or who is qualified to pose as a specialist or who has the particular knowledge of the subject, who is above the average and who can be expected to accomplish more than average results.

The dental profession itself is more or less able to decide on the qualifications

of a man specializing, because they should have some knowledge of the training he has received before he posed as a specialist. Taking orthodontia, for example, which is one of the earliest specialties of dentistry, the dental profession has been inclined to classify men who have specialized in orthodontia according to those who have taken post-graduate instruction and those who have not. They have also been classified to a certain extent by the membership which they have held in orthodontic societies, although a membership in an orthodontic society does not necessarily indicate a man's qualifications to practice a specialty neither does it indicate he has taken special post-graduate work. For instance, in the oldest society of orthodontists in the United States, in fact in the world, namely, the American Society of Orthodontists, all that is necessary to gain membership is to indicate that one is practicing orthodontia as a specialty. The Board of Censors has no power or right to disqualify him regardless of his ability to practice orthodontia as a specialty, regardless of his training before beginning to specialize. In other words, a man needs no qualifications, so far as ability is concerned, to become a member of the American Society of Orthodontists. He need not necessarily, have taken a recognized course of instruction in orthodontia, but all that is required of him is to have a nice card printed, and send out announcements stating the fact that he is specializing. In this manner he can become a member of the American Society of Orthodontists, after which he can use his membership as a recommendation to his patients, saying he is a member of the American Society of Orthodontists, and, therefore, a specialist because only specialists can belong to that society. In other words, the membership of the American Society of Orthodontists is open to the man who decides to specialize overnight. This is proved by the fact that there are a number of men in the society who have never indicated any special qualification as regards orthodontia. There are men in the American Society of Orthodontists as members who are considered "orthodontic jokes" among members of the dental profession in their community. As example of that we know of a man who is a member in the American Society of Orthodontists who was practicing in a small country town; believing orthodontia presented a future, he left the small country town and went to a larger town and sent out announcements that he would specialize in orthodontia. He applied for membership in the American Society of Orthodontists, and was admitted. However, the dental profession of the community have not taken his effort so kindly, and consequently have refused to recognize him as a specialist and he is not receiving the support of the dental profession which he would have received had he qualified along legitimate lines to practice orthodontia. No one ever thought he was interested in orthodontia. Before he decided to specialize he had never read nor discussed a paper upon the subject, and, so far as anyone is able to find out, he never treated a case of malocclusion. Nevertheless, the American Society of Orthodontists has placed its stamp of approval on him by admitting him as a member.

We know several other instances where men have taken up the practice of orthodontia as a specialty simply because they had been attracted to the field by the seemingly large amount of work that could be done along orthodontic lines, the large number of malocclusions that are to be treated, and by the supposition that all orthodontists are making money. Only recently we were approached by a

man of a small country town who desired to take a special course in orthodontia. He was informed regarding the next session of the school, the number of weeks required to complete the course, and that by no means would he be given a short special course of three or four days as he desired. He argued that he did not have sufficient time to spend eight weeks in taking a course, which everyone knows is short enough, that he must practice orthodontia immediately. When asked in regard to his qualifications, he said he had been reading the dental journals, had bought one or two textbooks on the subject, and had treated two or three cases of malocclusion in his practice. However, he was determined to be a specialist, and as a result he located in a larger city, sent out his announcements, and now poses as a full-fledged orthodontist. He will next apply for membership in the American Society of Orthodontists, and, as he is limiting his practice to orthodontia, he, of course, can qualify, and afterwards will probably use the fact that he is a member of the American Society of Orthodontists as an indication that he is a real specialist. Facing these facts, it is evident that there should be some means of designating who are specialists; there should be some means provided by the Board of Censors whereby it may be able to reject men who do not possess the qualifications of orthodontic specialists.

We know of a great many men doing orthodontia in general practice who are much better qualified to be specialists; who are much more entitled to membership in the American Society of Orthodontists than some of the "overnight specialists" who are now members. We could name a number of men whom we would rather trust with the treating of malocclusions of our friends or our friends' children than we would a number of specialists. We know a great many men in general dentistry who have spent years in studying orthodontia, who have taken special post-graduate courses in the orthodontic schools, and who are recognized by the dental profession in their community as having more than the average knowledge on orthodontic subjects. These men would be a credit to orthodontia as a specialty and they would also be a credit to any orthodontic society in the world because of their interest and mature judgment and their desire to practice orthodontia as a science.

However, orthodontia is not the only science or specialty of dentistry that is handicapped by the man who decides to specialize overnight. Oral prophylaxis, or the treatment of pyorrhea, as it is called, is also handicapped by men who, seeing a large field for such a specialty, decide to specialize overnight and their greatest qualification is the fitting up of a "swell" office, the purchasing of a compressed air outfit and a large number of instruments. They have absolutely no knowledge of pathological conditions; they are not able to recognize or differentiate pathological conditions of the oral cavity, but they are of the opinion that a finely equipped office, with nice lettering upon the door, and a long white gown will establish them in the eyes of the public as oral prophylaxis specialists and enable them to get larger fees than they would if not rated as specialists. Unfortunately the public has no way of designating or knowing when a man is qualified to specialize, therefore the necessity or the need of some action by the dental profession or by state boards which will put the stamp of approval on a man who has the ability to practice these specialties and which will eliminate those who have not the ability.

Prosthesis, or prosthodontia, has been similarly handicapped because there is

no means of preventing a man from specializing in those lines if he so desires. However, with these subjects it has not been so bad as with oral prophylaxis because a prosthodontist is compelled to deliver the goods before he gets very far with the public. With this kind of work, more than any other in dentistry, the public is able to judge results and consequently the specialists of prosthesis will have to be better qualified to exist in a community than the specialists in the branches above mentioned.

We might also refer to the man who is specializing in extraction and who is another individual who is compelled to produce results or his practice will not last very long. However, with the extracting specialist there is great danger of a large amount of harm being done before the public is aware of the man's inability and probably again there is no one of the dental specialties which the public has been able to recognize in so short a time; no dental specialty in which the public is able to place their stamp of approval upon a man so soon as the man who is engaged in extracting as a specialty. Of course, the extracting specialists, as a rule, and to a certain extent, assumes a legal obligation that is not assumed by the others mentioned, owing to the fact that he is compelled to use a large number of anesthetics, and, as a result, if he is not qualified in the administration of anesthetics, his mistakes may be more serious to the patient who consults him than would be the mistakes of other specialists.

When we come to radiography, we reach a specialty of dentistry which needs more regulation than probably any other because radiography is the only specialty in which it is possible for anyone, regardless of his training, to enter. As a result of this we have posing today as dental radiographers a large number of men who have absolutely no training along dental lines and whose qualifications for the practice of radiography is a little knowledge of electricity and photography. We will admit that a knowledge of electricity in the practice of the radiograph is a necessity, but we also claim that the x-ray specialist should have some knowledge of anatomical and pathological conditions; some knowledge of infection so as to avoid infection of one patient from another; some knowledge of clinical facts so that he can base his diagnosis of the radiograph upon clinical facts, as well as upon the appearance of the shadows. There should be some provision made to regulate the practice of all of these specialties, especially radiography. A regrettable condition has been brought about in the dental profession through the practice of radiography not being regulated. We know of men who prefer to send their patients to an x-ray laboratory—to a man who has no knowledge of dentistry—than to an intelligent x-ray specialist who is able to base the diagnosis upon the clinical evidence as well as upon the appearance of the radiograph. We know a large number of dental practitioners who say they do not want a radiograph made by a man who knows anything about dentistry because they do not want them telling their patients of the conditions which may be found in the radiograph as the result of the work which the dentist has done. Therefore, as a result of this attitude which the dental profession has assumed radiographic specialists or radiographic men who have no knowledge of dentistry have been able to exist and in some instances been able to build up large practices upon the jealousy or narrowness of the dental profession. It seems to us that the dentist is lowering his dignity by referring a patient to an x-ray man who has no knowledge of den-

tistry. In other words, he is calling into consultation with him on a professional matter a man who has no professional training. He is subjecting his patient to the hands of a man who has no knowledge of antisepsis and who is very liable to infect one patient from another because it is to be assumed that some time during the operation the x-ray man places his finger in the patient's mouth in placing the film. If this patient is syphilitic, infection may be carried to the next individual because of the inadequate knowledge which the radiograph operator has of those conditions. Without mentioning a large number of errors and false diagnoses which we have seen with radiographic lay operators, we contend it is a mistake for men to specialize as radiographers who have had no training other than a little knowledge of electricity.

While there is a need for regulation in all of the specialties, as well as radiography, the regulation of these specialties to a great extent lies in the hands of the dental profession. If the dental profession would insist that those who desire or claim to be specialists be trained along certain lines, take recognized courses in training, and avail themselves of every means of education possible to fit themselves for their specialty, we would soon have the "overnight specialist" eliminated because of lack of support. The dental profession should not support a man in a specialty simply because he is a good fellow and because he belongs to the same lodge, the same country club, or smokes the same brand of cigarettes as the dentist. A specialist should be judged upon his fitness; he should be judged upon his qualifications; he should be judged upon his standing in the dental profession; upon his ability as a man; and upon the attitude which he bears towards the code of ethics. The dentist assumes a certain obligation when he sends his patients to specialists, and assuming that obligation, he should insist that the patients be sent to men who are qualified along the lines indicated and who will not betray the trust that is given them.

Orthodontic Mechanics

IN this issue of the Journal is published a technical paper by Rudolph L. Hanau entitled "Orthodontic Mechanics: Dental Engineering." The paper is written from an engineering standpoint and may seem to be too technical to a number of orthodontic practitioners to have any practical value. Yet, it must be remembered that a certain part of the practice of orthodontia is necessarily mechanical, and a higher degree of efficiency will be maintained in the construction and use of regulating appliances if they are designed with a definite knowledge of scientific mechanical principles. The orthodontist who has a knowledge of scientific mechanics is better able to design and construct regulating appliances than one who has not that knowledge.

There has been a tendency among orthodontists for a number of years, and the idea has been fostered by the makers, patentees and dealers in appliances, that orthodontists should use appliances exactly as they were supplied by the manufacturer even if some small change would greatly increase the efficiency of the appliance. We realize that there is a great advantage in having appliances made by manufacturers but there is also a limit to the extent to which that is practical. To concede that a manufacturer who has never seen the particular

type of malocclusion can make an appliance which is best suited for that case and can make one which needs no adjusting, is claiming too much. We are willing to admit that appliances which have been manufactured by appliance makers have been used in the treatment of malocclusions and have accomplished very satisfactory results. We realize that there are certain mechanical principles that must be embodied in any regulating appliance and if an appliance is constructed to embody these principles, we can say that the appliance approaches a universal appliance as nearly as it is possible to have such an appliance. The use of the screw and the lever as combined in the alignment wire has for a long time been the most universal appliance that we have. Even with such a universal appliance as the alignment wire, the efficiency of the same can be greatly increased in certain cases by making changes in the appliance along scientific engineering lines.

The modification of a stock appliance to meet the requirements of certain cases often calls into use a knowledge of mechanics which is not possessed by everyone practicing orthodontia. In the use of regulating appliances it must be remembered that there are certain mechanical principles which have been recognized by engineers for years and which can be used to a great advantage in orthodontia. There are laws governing force, resistance, velocity, and power which should be remembered in the construction of regulating appliances. We do not mean that every appliance used on a case of malocclusion has to be different from the one previously used, but such changes as are made in regulating appliances must be made to conform with definite mechanical laws and not based on the idea of some manufacturer of appliances that are made to sell and not necessarily made to fit the individual case. Each appliance should be made so as to conserve the anchorage and resistance and constructed so as to utilize all of the forces of the appliance without causing any undesirable change in some other part of the mouth.

We believe it is time for orthodontists to realize that they must have a greater knowledge of physics and mechanics than they have had in times past. We believe a careful reading of the paper on orthodontic mechanics will be a great benefit to anyone interested in better mechanically constructed appliances. Not only should this paper be studied, but it would be time well spent for the majority of the orthodontic profession to take up a study of engineering principles and apply them to their work to a greater extent than they have heretofore. If this is done, we do not believe that the orthodontists will be imposed upon by manufacturers of certain types of appliances and we do not believe that they will be induced to use appliances which are woefully lacking in design, as some have done in the past.

Partial Program of the National Dental Association

UP to date the following reports have been received from the various Section Chairmen, Committeemen, etc.

SECTION I.

Chairman Dr. E. D. Coolidge, 59 East Madison Street, Chicago, Ill.

"Some Neglected Operative Pre-requisites," By Dr. Fred E. Hart of San Francisco.

"Porcelain Inlays" (exact title not yet chosen). By Dr. W. L. Fickes, Pittsburgh, Pa.

"Interpretation of Radiographs," By Dr. Howard R. Raper, of Indianapolis, Ind.

"Present Tendencies in Operative Dentistry," By Dr. J. M. Walls, of St. Paul, Minn.

Also an important paper dealing with the subject of dental education. Essayist not selected as yet.

SECTION II.

Chairman Dr. F. B. Moorehead, People's Gas Building, Chicago, Ill.

Dr. Virgil Loeb, of this Committee, reports that he has thus far accepted two essayists. Dr. Elmer S. Best, of Minneapolis, on some phase of root canal filling; and Dr. Howard R. Raper, of Indianapolis, on "Misinterpretation of Radiographs."

SECTION III.

Chairman Dr. L. E. Custer, 28 North Ludlow Street, Dayton, Ohio.

"Ionization, With Special Reference to Ionic Chemistry," By Dr. Geo. T. Fette, Cincinnati, Ohio.

"The Chemical Action of Soil Bacteria on Calcium Phosphates, With the Chemical Analysis of the Human Teeth," By Dr. J. E. Hinkins, of Chicago, Ill.

"Why Measurements of the Mandible, Tracings of the Condyles, the Construction of Hypothetical Triangles, and the Use of the Face-Bow, are all Non-Essential in the Construction of Dentures Possessing the Highest Degree of Efficiency," By Dr. D. D. Campbell, of Kansas City, Mo.

"Paper, subject to be announced later," By Dr. Calvin S. Case, of Chicago, Ill.

Also two other papers, titles of which will be reported later.

STATE SOCIETY OFFICERS' SECTION.

Chairman Dr. John C. Forsyth, 430 East State Street, Trenton, N. J.

First Session. "Some Phases of Post-Graduate Work," By Dr. B. L. Shobe, Tulsa, Okla.

"Securing Some Satisfactory Legislation," By Dr. Alexander H. Reynolds, Philadelphia, Pa.

The Second Session will be devoted to six or seven short papers of five to ten minutes each by men of different State Societies, telling of some outstanding feature of their State Society's work that is thought to be of the greatest importance, or, if the essayist prefers, he may present the weak part of the work and ask for suggestions to help them out. These papers are to be followed by a general discussion which we hope will bring out some very valuable points. The means of the essayists for this session have not as yet been secured.

COMMITTEE ON ANESTHETICS.

The Secretary of this Committee, Dr. Chalmers J. Lyons, of Ann Arbor, Mich., reports as follows:

"The Teaching of Conductive Anesthesia," By Dr. Theodore Blum, of New York City.

"After-Pain in Local and General Anesthesia," By Dr. A. E. Hertzler, of Kansas City, Mo.

"The Toxicity of Local Anesthetics," By Dr. Geo. B. Roth, of Washington, D. C.

COMMITTEE ON ENTERTAINMENT.

At a recent meeting of this Committee a Ladies' Auxiliary was organized, of which Mrs. M. L. Rhein was made the chief officer, and Mrs. Henry W. Gillett, 140 West 57th Street, New York City, Secretary. It would greatly facilitate the endeavors of the Ladies' Auxiliary to add as much as possible to the pleasures and comforts of the visiting ladies, if those who intend to come to New York would notify Mrs. Gillett, stating if possible, the hotel at which they will be registered.

R. OTTOLENGUI, Chairman Publicity Committee.

The Seventeenth Annual Meeting of the American Society of Orthodontists

THE Seventeenth Annual Meeting of the American Society of Orthodontists will be held at Excelsior Springs, Mo., September 5, 6, 7, and 8, 1917. Excelsior Springs is thirty miles northeast of Kansas City, "the Heart of America," and no other place can be reached so conveniently and quickly from all parts of the United States.

The meetings will be held at the Elms Hotel, which is conceded by all travelers to be unsurpassed by any hotel in the world. The beauty of its architecture, the

The Elms Hotel at Excelsior Springs, Mo.

charm of its interior arrangement, and the home-like atmosphere of every appointment, make it a desirable place to hold a meeting away from the noise and confusion of the large commercial hotels. The large shady lawns lend a restful air to the place, which invites one to combine business with pleasure.

The Board of Censors is preparing an unusually attractive program, which has been arranged as follows:

I. President's Address, Dr. M. N. Federspiel, Milwaukee; Report of the Board of Censors.

II. Anatomy and Physiology.—(1) The Evolution of the Human Teeth, Prof. H. F. Osborn, New York City.

III. Medicine and Therapeutics.—(1) Constitutional Diseases in Infancy and Dentition, Dr. Gustav Lippmann, St. Louis; (2) The Oral Efficiency of Therapeutic Preparations, Prof. Hermann Prinz, Philadelphia; (3) The Scientific Feeding of Growing Children, Mr. A. W. McCann, New York City.

IV. Surgery.—(1) The Surgical Treatment of Extreme Malformations Involving the Jaws, Tongue, etc., Dr. Gordon New, Rochester, Minn.

V. Radiography and Photography.—(1) Practical Radiography for the Orthodontist, Dr. E. H. Skinner, Kansas City; (2) Orthophotography and Multiview Projections, Mr. Rudolph L. Hanau, Pittsburgh.

VI. Etiology, Pathology, and Prognosis.—(1) A Further Study of Prenatal Causes of Dento-facial Deformities, Dr. B. W. Weinberger, New York City.

VII. Practice and Technology.—(1) Subject to be announced, Dr. Calvin S. Case, Chicago; (2) Further Experiences with the .020 Arch-wire, Dr. Ray D. Robinson, Los Angeles; (3) The Indirect Method of Anchor-band Construction, Dr. Martin Dewey, Chicago; (4) Subject to be announced, Dr. Lloyd S. Lourie, Chicago.

VIII. Legislation, Education, and Nomenclature.—(1) Report of the Committee on Education; (2) Report of the Committee on Nomenclature.

IX. Clinics.—A large number have already been secured, to be announced later.

X. Exhibits.—Manufacturers and publishers of books, periodicals, x-ray and photographic equipments, orthodontic appliances and supplies, have been invited to exhibit during the meeting.

Man-Power

I HAVE heard many stories (says "Diarist" in the *Westminster Gazette*) of the curious way in which "man-power" is estimated by the military authorities and by the tribunals. There seems to be no doubt that many men who ought to be in the Army are being enabled to avoid their obligations; but this mistake is certainly not counterbalanced by the fact that men are being taken into the Army who could be far more useful elsewhere. A huge military hospital that devotes its attention to wounds of the jaw had one man, and one only, who is an expert in the making of splints for the jaw. He has been "called up," and is possibly sweeping out a camp cook-house somewhere at present. Another hospital, in another part of the country, has lost several highly-trained, operating-theatre attendants. Each can probably do less than the work of an average soldier in the fighting line, but a score of average soldiers could not do his work at home.

The International Journal of Orthodontia

Editor: Martin Dewey, D.D.S., M.D.

VOL. III | ST. LOUIS, AUGUST, 1917 | NO. 8

ORIGINAL ARTICLES

THE RELATION BETWEEN MALOCCLUSION AND NASAL DEFORMITIES

BY MARTIN DEWEY, D.D.S., M.D., CHICAGO, ILL.

IT has long been recognized that there is a relation existing between malocclusion of the teeth and deformities of the nasal cavity, but there has been some dispute in regard to what relation one has to the other and which is the causative factor and which is the effect. In considering the etiology of malocclusion, we have learned that a certain number of malocclusions are caused by mouth breathing which is produced by abnormal forces of occlusion resulting from a disturbed function of the muscle and abnormal atmospheric pressure. It has also been observed that certain types of nasal deformities are almost invariably associated with certain types of malocclusion, and it has long been recognized that many of these types of nasal deformities can not be improved to any great extent unless the treatment is associated with the correction of the malocclusion.

There are a number of individuals who are suffering from mouth breathing in whom the mouth breathing has undoubtedly been caused by hypertrophy of the lymphoid tissue in the nasopharynx and upon removal of this lymphoid tissue the mouth breathing still persists. This is because the abnormal action of the muscles and abnormal atmospheric pressure during the time the individual has been a mouth breather has produced a malocclusion and along with the malocclusion has been produced a deformity or abnormal development of the nasal cavity. We are then naturally confronted by the question as to what relation exists between malocclusion of the teeth and deformed nasal cavities, which is the causative factor, and which is the effect, and what benefit can be expected to be derived from the correction of malocclusion so far as the deformed nasal cavity is concerned. Considering the relation between malocclusion and deformed nasal cavities, it is well to remember the anatomy of the

parts concerned. It must be remembered that the nasal and oral cavity as they are found in the adult have at one time been a common cavity which may be described from an embryological standpoint as consisting of a single opening at the anterior end of the alimentary canal which is known as a stomodæum. It must be remembered in the early life of the individual that the nasal and oral cavities are one cavity without any separating structure, or, in other words, the

Fig. 1.—Drawing showing embryonic development of roof of mouth.

Fig. 2.—Cross section of developing nasal and oral cavity of embryo pig. (After His.)

hard and soft palates have not yet developed to separate the nasal from the oral cavity.

In the development of the nasal and oral cavity we find the first branchial arch and the fronto-nasal process play a very important part. The first branchial arch divides into two parts, one of which is known as the mandibular portion, and is the lower part; and the upper portion known as the maxillary portion

Fig. 3.—Cross section of developing nasal cavity after the union of the palatal processes of the superior maxillæ. (After His.)

which grows from the superior right and left side of the mandibular arch and finally unites with the frontal-nasal bud in that region which may be compared to the lip or alveolar border. From the inner posterior portion of the first branchial arch there grows a shelf or offshoot which finally unites in the median line which forms the hard and soft palate. It is a formation of the hard and soft palate which separates the nasal from the oral cavity.

The developments of these parts can be observed in Fig. 1, which is copied after His. Another structure or development which must be considered in relation to malocclusion and deformity of the nasal cavity is the development of the nasal septum, the turbinated body shown in Fig. 2. Growing downward from the base of the cranium, or from the chondro-cranium, is a cartilaginous structure or rather structures which make up or contribute to what is known in later life as the nasal septum. Growing down from the horizontal plate of the ethmoid is the perpendicular plate of the ethmoid, which grows downward into the nasal cavity towards the median line or the junction of the hard palate. From the base of the sphenoid we find another cartilaginous structure which grows forward and which is known as the cartilaginous vomer. It is later replaced by intramembranous bones developing on the right and left sides of the cartilage. Associated with the perpendicular plate of the ethmoid and the vomer we have

Fig. 4.—Posterior view of nasal cavity showing bony cavity which contains the nasal septum.

a cartilage known as the triangular cartilage which completes what is later known in life as the nasal septum. The downward growth of the perpendicular plate of the ethmoid and the vomer occurs regardless of the development of the lateral halves of the nasal cavity. They occur regardless of the development of the floor of the nose and it is this factor which must be kept in mind in considering the relation of the deformity of the nasal cavity in relation to malocclusion. As the nasal septum grows down from the chondro-cranium the horizontal plate of the superior maxillary bone, which has been developed in the maxillary bud of the first branchial arch grows towards the median line and the structures unite at the median line forming the floor of the nose, the nose being

divided by the nasal septum into the right and left nares. The embryonic development of the nasal septum and the floor of the nose is shown in Fig. 3.

Fig. 4 is a posterior view of the maxillary bone and the mandible showing the bony wall of the oral cavity and the nasal cavity as viewed from the posterior border. It will be seen that the hard palate or the roof of the mouth also forms the floor of the nose. The right and left halves of the nares are made up by the perpendicular plate of the superior maxillary bone or the nasal process of the superior maxillary, while the superior lateral walls of the nose are made up of the lateral masses of the ethmoid. The horizontal plate of the ethmoid assisted by a small portion of the frontal and body of the sphenoid bone forms the roof of the nose. Thus the nasal cavity is formed, completely surrounded by a bony structure and divided by the nasal septum. The nasal cavity is separated into the right and left nares by the nasal septum which has grown down from the perpendicular plate of the ethmoid, the body of the sphenoid, and which grows down toward the roof of the mouth in the median line. The nasal

Fig. 5.—Diagram of nasal septum. *T.C*, Triangular cartilage; *E.*, Perpendicular plate of ethmoid; *V.*, Vomer

septum is primarily of cartilaginous origin and is replaced by an osseous structure. Physiologically the nasal septum has nothing to do with respiration. From an evolutionary standpoint the vomer was originally a tooth-bearing bone and has been walled off in the nasal cavity during the process of evolution.

As we study this question further we find that the factors which affect the development of the lateral walls of the nasal cavity and the floor of the nasal cavity do not necessarily affect the septum. As a result of this, there are certain types of malocclusion in which the nasal cavity does not develop as rapidly as it should. The nasal septum will continue to grow downward and meeting with resistance from the floor of the nose, will become deflected. Fig. 5 is a diagram showing the various parts of the nasal septum, of which *T.C* is the triangular cartilage, *E* is the perpendicular part of the ethmoid, and *V* is the vomer. It will be observed that the vomer grows downward and forward originally in cartilage and is later replaced by intermembranous bony development on both sides of the cartilage and the cartilage disappears. As a result of this, the vomer may be considered a double structure composed of a right and a left

side. The perpendicular plate of the ethmoid grows downward from the horizontal plate of the ethmoid and joins the vomer and the triangular cartilage. The anterior portion of the nasal septum is completed by the triangular cartilage which is also subject to a great many deformations which may be the result of abnormal development of the nasal cavity as the result of injury. Carefully studying Fig. 5 you will see the nasal septum is enclosed between two bony walls or surfaces which are the roof of the nose and the floor of the nose. The distance between the floor of the nose and the roof of the nose is dependent upon the development of the lateral walls of the nose, the principal portion of which is the superior maxillary bone. Therefore, if any condition arises that interferes with the growth of the superior maxillary bone it necessarily will cause a shortness between the floor of the nose and the roof of the nose. The nasal septum will be compelled to occupy a smaller space than it was originally intended to occupy.

Fig. 6.—Nasal septum enclosed in nasal cavity.

It is also a fact that conditions which affect the development of the lateral wall of the nose do not affect the nasal septum. Therefore, in a great many types of malocclusion we find that deflected nasal septi are the result of the lack of development of the lateral walls of the nasal cavity and the superior maxillary bone which have resulted in a lack of distance between the roof and the floor of the nose. Fig. 6 shows a condition of a fetus skull at birth and it will be observed at this time that the bony septum or nasal septum is enclosed in the bony walls of the nasal cavity. It will also be observed that the roof of the mouth is comparatively flat, that the alveolar process is close to the

orbital cavity, and that there must be great increase in distance between the floor of the orbital cavity and the alveolar process as the individual develops. The inferior turbinated bone is very close to the roof of the mouth or floor of the nose with the result that as the individual grows the nasal cavity increases in length especially between the inferior turbinated bone and the floor of the nose.

As this floor of the nose is carried down by the development of the lateral walls, space is made for the nasal septum and if development goes on harmon-

Fig. 7 Nasal cavity of an adult.

iously, we find a development occurring which in the adult is the same as we find in Fig. 7. It will be observed that there is a tendency for the nasal septum to separate into two parts showing the tendency for the organ to be developed into a right and a left portion.

Fig. 8 is the posterior part of the skull shown in Fig. 7 and it shows the shape of the roof of the mouth, which is a beautiful arch, the development of the maxillary sinuses, and the increased distance between the inferior turbinated

bones and the floor of the nose. This skull may be considered showing a normal development and one in which there is a normal nasal cavity associated with what was a normal occlusion. In certain types of malocclusion which may be neutroclusion or Class I complicated by lack of development of the dental arches, or which may be distal occlusion complicated by labioversion of the upper incisors (Class II, Division 1), or in fact in any individual who is a mouth breather, one is very liable to have an abnormal development of the nasal cavity because of the abnormal development of the superior maxillary bone.

Fig 8.—Showing double plates of nasal septum.

If the lateral walls of the nasal cavity do not grow down sufficiently rapidly there will be a decrease in distance between the floor of the nose and the roof of the mouth which will result in a deflected septum. The removal of adenoids does not benefit this condition because the only thing that will restore the development of the nasal cavity to the proper size is the treatment of the malocclusion, which will produce the proper growth of the superior maxillary bone and result in changes in the entire nasal cavity. It has long been recognized by a large number of men that the correction of the malocculsion has produced a beneficial result in the deformity or lack of development of the nasal cavity. This observation has led to several plans of treatment, some of which are based

only on the correction of malocclusion with the resulting change in the nasal cavity while other plans of treatment are based on the correction of the malocclusion with the idea of improving the nasal cavity by changing the shape by mechanical interference.

A number of cases reported several years ago by Ketcham showed that in the treatment of malocclusion in patients who were mouth breathers the nasal cavity increased very materially in size and deflected septi disappeared or improved during the process of treatment. Observations made in my practice have substantiated this fact, so I can state that the correction of the malocclusion in the young individual when the superior dental arch is not properly developed will practically remove the deflected nasal septum. It has also been observed in older individuals suffering from nasal stenosis in which there was insufficient space in the nasal cavity, especially in a lateral direction, that by an expansion of the dental arch an increased nasal space is produced and normal breathing becomes possible.

By study of Figs. 4, 7, or 8, from a purely mechanical standpoint, it will be seen that any device or kind of treatment which will expand the dental arch and expand the alveolar process of the superior maxillary bone will necessarily produce some change in the width of the nasal cavity. The change in the width of the nasal cavity can be produced in several ways. It must be remembered that the teeth are embedded in the peridental membrane which is a continuation of the muco-periosteum which covers the floor of the nose and the roof of the mouth, and is made up of white inelastic fibers. By an expansion of the dental arch stress is brought to bear upon the fibers of the peridental membrane which in turn is transmitted to the periosteum covering the floor of the nose and roof of the mouth and this exerts an influence upon the floor of the nose to such an extent that the shape of the floor of the nose will be changed and with individuals who have high narrow arches, the roof of the mouth will be changed in height and width. If the nasal cavity is examined in these individuals before treatment is begun, it will be observed that either the nasal septum is deflected or that there is a lack of width between the lateral walls of the nose.

As the change occurs in the roof of the mouth and the nasal cavity is again examined it will be found that the nasal septum has straightened and there has been an increase in width between the lateral walls of the nose. In other words. there has been a change in the roof of the mouth. It has been made wider and the roof of the mouth is lower from the base of the cranium. Some of this change in the roof of the mouth is the direct result of mechanical pressure while more of it is the result of a growth produced by mechanical stimulation and the result of cell metabolism and changes in the structure as a result of natural growth. It must be remembered that the superior maxillary bone is a bone of environment and responds to mechanical influence and stress; and by changing the position of the teeth so as to change the stress upon the bone, the entire superior maxillary bone will be changed in the growing individual. In fact, a great change will also occur in older individuals which has been observed in my practice. The cases which Ketcham reported and the cases observed in my practice were changes which were produced by ordinary orthodontic treatment, which were the result of slow and gradual pressure upon the teeth without any

direct effort being made to change the shape of the maxillary bone as the result of direct mechanical pressure.

A number of other men have reported cases in which the superior maxillary bone has been changed in shape and in which the nasal cavity has been changed by exerting pressure upon the teeth and the superior maxillary bone with the idea of changing the shape of the roof of the mouth as a result of direct mechanical pressure. This treatment has been based upon the idea that by pressure the median suture between the right and left superior maxillary bone could be opened and as the result of opening this suture a lateral expansion of the nasal cavity would occur.

While I have never followed this plan of treatment in active practice, nevertheless I am convinced that it is possible to open the intermaxillary suture by the construction of special appliances, and, in fact, it may be done in some cases with any appliance. I have done this experimentally upon dogs at different times without any seemingly ill effect upon the dogs and with the result that the bone has filled in the open suture and the nasal cavity has been increased in width. There is no question but that there are extreme cases of nasal stenosis, narrow dental arches with high palate, in which it is desirable to construct some style of appliance especially suited to widen the lateral halves of the superior maxillary bone, not so much with the idea of opening the median suture as with the idea of producing a bodily movement of the teeth and carrying out the lateral halves of the superior maxillary bone as much as possible. This can be produced by constructing appliances which consist of bands placed upon the molars and the canine teeth, or upon the teeth of the two lateral halves of the arches; and then by the use of alignment wires in such a manner that a direct buccal pressure is exerted upon the teeth, they are forced to move bodily thereby carrying the superior maxillary bone or alveolar process with them in a bodily direction.

In young individuals who have only the deciduous teeth or the deciduous molars and permanent molars, the construction of an appliance for the purpose of producing bodily movement is very unsatisfactory if the appliance is attached directly to the teeth, because it will loosen the deciduous teeth. However, we find that cases at that age are the most desirable for treatment and to overcome the difficulty encountered with loose deciduous teeth the use of the plate has been employed to exert pressure upon the alveolar structures through the soft tissue.

The coffin split plate presented some advantages in the treatment of these cases. The idea has later been modified by other individuals including a device which was published several years ago by Ottolengui, and a modification of the split plate which is used at the present time by Richardson. I have seen a number of cases in Richardson's practice in which this appliance has been used and the results have been very pleasing and satisfactory. All the patients report a great improvement in nasal breathing, improvement in speech, and individuals who before this treatment were only able to breathe through the mouth now breathe through the nose entirely during the day and night.

The appliance, by exerting a gentle pressure on the soft tissues, carries the lateral halves of the superior maxillary bone laterally either by direct mechanical

influence or by development. The roof of the mouth is changed, the nasal cavity increased in width and deflected nasal septi are straightened because of the increased room that is made for them. I do not believe that the changes which occur in all of these cases are the direct result of mechanical pressure changing the shape of the parts, but are the result of mechanical stimulation of the cells which produces a development which has been retarded and consequently the parts assume a normal proportion and shape resulting in a normal development of the nasal cavity following the correction or treatment of the malocclusion.

Fig. 9.

Fig. 10.

Fig. 9 shows a model of a young patient in whom the only permanent teeth present are the first permanent molars with a high narrow arch. These patients suffer from mouth breathing and invariably show deflected nasal septi and nasal cavities which are below the normal width. The removal of adenoids or tonsils which are usually present does not improve the nasal breathing because of the deformed nasal cavity. The appliance is constructed by making bands upon the permanent molars and the deciduous teeth and adjusting a lingual wire which extends from the canine to the molar bands. This wire should be at least a 16

Fig. 11.

Fig. 12.

gauge wire so as to be of sufficient size to enable the roof plate to grasp the wire securely. After the appliance has been constructed, or rather after the bands have been made for the molars and canines, and the lingual wire is put in position as shown in Fig. 9, the roof plate is made in the ordinary manner of waxing up with base plate wax until it is of the desired thickness. A spring of some sort is embedded in the wax as is shown in Fig. 10 and then the plate is vulcanized in the ordinary manner.

This spring, which is embedded in the roof plate, must be made in the form

of a W as shown in Fig. 10 in order to give it a greater range of elasticity and enable it to be so adjusted as to exert a greater expansion either on the canines or molars. If the spring is made in the form of a W, it can be opened and greater pressure exerted on the canines than on the molars or can be opened in the posterior border in such a manner as to exert a greater pressure on the molars than on the canines. After the plate is vulcanized it is separated in the middle as shown in Fig. 11 and then by opening the spring the desired amount of pressure can be produced upon the canines or molars.

Fig. 12 shows the palatal view of the plate which is shaped to fit the soft tissue accurately, and pressure will be brought to bear upon the soft tissue and be evenly distributed and produce no soreness. A groove in the gingival border of the plate catches under the lingual wire extending from the canine to the molar and thereby holds it in position. The result produced by this plate is very gratifying because the loose deciduous molars are moved bodily, the roof of the mouth changes shape, the nasal cavity increases in size and the results from the use of this plate could not be surpassed by any other form of appliance. The treatment produces a change in the shape of the roof of the mouth and the shape of the superior maxillary bone and also produces a change in the nasal cavity. With the use of this plate no provision is made to exert pressure upon the anterior teeth if they are protruding and therefore the alignment wire

Fig. 13

must be used to exert pressure on the upper incisors in cases where the upper incisors have erupted.

In young patients in whom the permanent incisors have not erupted, the only kind of treatment necessary at this time is the widening of the superior dental arch so far as the upper teeth are concerned, allowing the deciduous teeth to assume such positions as they will assume as the result of change in the atmospheric and muscular pressure, and the probabilities are, if sufficient space is made for the upper central incisors and the individual is a normal breather at the time they erupt, they will take their normal position. If it is necessary to use an intermaxillary anchorage to correct the mesio-distal length of the arches with the use of this roof plate intermaxillary hooks can be placed on the canine bands to be attached to the lower appliance in the usual manner.

If the patient is more advanced in age and it is desired to bring pressure upon the upper central incisors to correct a protrusion, this can be accomplished by soldering tubes upon the buccal surface of the molar bands which will receive a labial arch as illustrated in Fig. 13. By bending the labial arch gingivally as it leaves the buccal tube it is carried far upon the gingiva and then by using finger spurs pressed against the protruding incisors the appliance is made very

inconspicuous. The use of the labial arch in no way interferes with the action of the roof plate. The appliance is as inconspicuous as any appliance that can be used. Intermaxillary anchorage can also be employed by having the spurs soldered on the canine bands or by having an intermaxillary hook attached on the labial arch. It would be preferable, in using intermaxillary anchorage, to have the spurs attached to the canine band because that would give a greater

Fig. 14.—Showing nasal septum bent from before backward.

rigidity and the intermaxillary rubber would not have a tendency to displace the labial arch as it would if they were attached to the labial arch. The combination of the labial arch with the finger spur, as used by Lourie, employed in conjunction with the roof plate, as used by Richardson, gives a very ideal appliance for the treatment of patients suffering from deformed nasal cavities, narrow arches, and high palates, in which it is desirous to move the teeth bodily

by pressure on the alveolar plates and produce as great a change in the nasal cavity as is possible.

In the increase of width of the dental arch and the increase of space in the nasal cavity, deflected septi are corrected provided the deflection is from above downward. Such deflections as are shown in Fig. 14, from before backwards, and which probably are the result of traumatism, are not corrected or benefited to any great extent by the correction of malocclusion. In beginning the treatment of a malocclusion, it is very necessary that a careful diagnosis of the malocclusion be made, as well as a careful examination of the nasal cavity, in order to recognize the condition of the nasal structures. Then the appliance must be selected with the idea of producing, as nearly as possible, the ideal results. While it is possible to produce a great change in the nasal cavity, care must be taken not to promise the patient too much; and to remember that only certain types of deflected nasal septi can be corrected.

It is my belief that in the majority of cases in which there is a lack of width between the lateral walls of the nose, this can be changed, the nasal cavity caused to increase to its proper size, and a great benefit produced, so far as respiration is concerned, provided the proper treatment is instituted. In a large number of nasal deformities there is nothing which offers so much benefit as the proper correction of the malocclusion with the idea of producing a normal nasal development.

THE HISTORY OF ORTHODONTIA

(Continued from page 171)

By Bernhard Wolf Weinberger, D.D.S., New York City.

W. K. BRIDGMAN, *"On Lateral Pressure," Transactions of the Odontological Society of London,* 1859, contributes the following:

"Lateral pressure is a term usually applied to certain results arising from an abnormal state of the human denture.

"It is by no means restricted in its application, but is commonly assigned as a cause for any particular effect, either of crowding, or decay in the teeth, or any deviation from the normal condition. But, although it is thus the assertion of a fact of a common occurrence it does not appear to have been made the subject of especial attention; nor, so far as I am aware of, has any attempt been made to point out its original source or manner of being produced, or of the circumstances under which it may arise.

"The immediate action upon the teeth to which this appellation is commonly

Fig 1—After Gaines (1858)

applied, is merely 'the expression of some other and more remote force.' There are three separate and distinct causes whence this force may be derived.

"The first, and most obvious, is that arising from the force of growth—the *vis incrementi.*

"The second is the *vis extensionis,* or pressure caused by the muscles of the cheeks and lips upon the outer curve of the dental arch, and by the expansion of the tongue in sucking, etc., within the arch.

"And, thirdly, the *vis occlusionis,* or under pressure, caused by an imperfect 'bite.'

"We also frequently see the anterior portion of the upper denture rendered unnaturally prominent by sucking the finger or thumb, or by biting the lower lip; and therefore it may be fairly inferred that should any other part of the mouth, under any particular circumstances, be in a position to exert a pressure upon the teeth, it would be followed by corresponding results.

"That such an effect does in reality occur, and that the 'form of the palate,' in combination with the size and shape of the tongue, is the means of producing the particular form of the dental arch by which they are accompanied, has, to me, long ceased to be a matter of doubt.

"But when it can be shown, that with this particular form of the palate vault, the tongue in sucking or in mastication, by its pressure is capable of producing the expansion of the jaws, and that when the palatal vault is differently formed, so that no pressure can be exerted by it upon the teeth during mastication, etc., the expansion of the jaws does not take place, it will scarcely be doubted but that they are in reality to each other as cause and effect. It is, moreover, in the absence of the possibility of this pressure by the tongue within the arch, that nearly all cases of irregularity occur.

"In every variety of form of the dental arch, a particular shape of the palate will invariably exist in connection with some few other peculiarities which are corresponding accompaniments. Thus, where the palate is broad and shallow, the palate processes of the upper maxillæ presenting a considerable area of horizontal surface, and gradually shelving off to the alveolus at an angle of about 45°, the tongue large and broad, the teeth are comparatively small and wanting in boldness of outline, and rarely or never irregular in position, although occasionally producing supernumerary or 'pin' teeth among the upper incisors. But in the opposite extreme, we shall find the palatal vault deep, narrow, and angular; the tongue thick, narrow, and tapering; the alveolar ridge thick, prominent, and almost perpendicular; the teeth large, and fully developed, thickly but unevenly coated with enamel, and bold in outline, but almost invariably more or less irregular in position. Under these conditions in the act of sucking (which becomes extremely difficult, and sometimes almost impossible in the case of a very deep and pointed arch), there will be no lateral expansion of the tongue. All the effort will be drawn up and thickened vertically. Hence the action of the muscles external to the arch will be to press the teeth inwards, and to cause them to assume an irregular line and to overlap one another; the two upper maxillæ in extreme cases having the appearance of being compressed together inwards.

"In the correction of irregularity by the expansion of the arch (and which is extremely easy by pressure applied within the arch), it becomes a question how far this extension can be carried with safety; for if the teeth be placed much within the influence of lateral pressure from the action of the muscles of the face, we run great risk in having them made to decay. The amount of it must therefore be guided by circumstances; for although we have hitherto contrasted only the extremity of both forms, others will be found merging from one into the other in every stage of graduation, with more or less difference in their relative portions.

"In the third and remaining source of lateral pressure, its occurrence may be attributed to accidental circumstances producing imperfect antagonism of the teeth.

"In a perfect 'bite' we have everywhere a series of inclined planes in opposition.

"The proper antagonism of the teeth is of the very utmost importance, for if any of the 'cusps' be out of place, they disturb the equal distribution of the force in biting, and tend to produce mischief at the points holding those cusps in their assumed position. In regulating the mouths of children, it is of far

more consequence to secure correctness in this respect, than as to the actual number remaining, provided the symmetry of the anterior portion of the denture be not interfered with."

John Fletcher.—On page 213 of the same journal we find reported a paper read before the Odontological Society of London, by Fletcher on *"Mechanical Appliance for Reducing Irregularity."*

"For my own part I prefer getting the teeth into position at as early an age as I possibly can: although frequently attended with much greater difficulty, the advantage of the teeth being directed into the proper position, while the process of the new formation is in vigorous operation, fully compensates for any extra trouble the case may possibly have given, but it most frequently occurs that we have not this choice given us, and besides cases have been most successfully treated up to twenty-five, and even thirty years of age.

"Formerly when the position of a tooth was required to be moved, recourse was had to a gold plate, or bone-piece fitted to the mouth, which was used for drawing the teeth inwards by means of silk ligatures passed through holes made in the plate, and tied over the teeth; or by means of a spiral spring, one end of which was attached to the plate, and the other by means of a ligature, tied to the tooth, whereby a constant tension was kept up.

"For the purpose of drawing a tooth forward, a stout gold bar was made, and kept some little distance in front of the tooth to be brought forward; the ends of the bar being tied to the back teeth, silk ligatures were passed around the tooth, and through holes in the bars, drawing the tooth forward.

"I capped with gold the back teeth of the under jaw, uniting the caps on both sides of the mouth by a narrow, stout, gold band, passing in front and resting against the anterior teeth, to the buccal sides of the caps; to the side of the cap from about the second bicuspid to the first half of the first molar, was soldered a stout piece of gold plate, projecting upwards about half an inch, cut at about an angle of sixty degrees, sloping upwards from the bicuspid to a parallel line from the middle of the molar. The upper plate was made capping the back teeth, and covering a portion of the lingual surfaces of the anterior teeth. A small thick piece of gold was soldered to the buccal sides of the caps, into which was screwed a strong gold pin, which, on any effort to close the mouth rubbed against the inclined edge of the under piece, forcing the under jaw back. As the caps came into contact, the points were filed away, until the teeth themselves nearly met.

"This I adopted in preference to the strap on the chin and strong elastic bands carried to the back of the head, which I had found considerably increased the inconvenience to the patient, and was much less effective in its operation.

"Another plan is sometimes used for the upper central incisors, where, from the persistence of the temporary teeth, the permanent have made their appearance considerably on the lingual side of the alveolar ridge. This is very simply remedied by means of a piece of bone fitted against and rather beyond the edges of the growing teeth, which, as they descend, the thicker part of the teeth rubbing against the bone, forces them forward into their proper line.

Nature might possibly correct this state, if the under teeth did not interfere on closing the mouth.

"A very useful and effective method of sustaining pressure on any part of a tooth is frequently resorted to, especially for the purpose of turning it, by means of a piece of flat gold plate."

Edwin Sercombe, Transactions of the Odontological Society of London, page 218, describes a plan he adopted for expanding *the arch of the mouth*. "It consists of capping the two first molars, and connecting the caps by means of a gold bar across the palate. On the buccal sides of the caps is attached a strong elastic band, which passed in front of the central incisors, and was attended with complete success in the case in which it was used. The band is occasionally made to press against the lingual sides of the molars and bicuspids for the purpose of expanding the arch of the mouth, and which I have used most successfully in some of the most difficult cases.

"By means of two gold plates fitted to the grinding surfaces of the bicuspids and first molars, and connected by a spiral spring keeping up a constant pressure outwards, he afterwards fitted a bone plate to the hard palate; on to the bone was riveted a piece of metal, to which was soldered four grooved pieces, for the purpose of carrying compressed hiccory in order to force the anterior teeth forward. And in another case he succeeded in drawing into line a lateral incisor and cuspid by means of a bone-piece, to which he attached elastic bands, one passing through a hole cut in the bone for the purpose of keeping the band on the cuspid, which was only partially erupted."

W. A. Harrison in the same article says: "By taking a piece of dry willow, or any fine-grained wood, that is as free from resin as possible, and compressing it by screwing it up between the jaws of a parallel vise for about forty-eight hours, occasionally, as it becomes compressed, screwing the vise up more.

"A bone-piece is fitted to the mouth, and behind the tooth to be brought forward is cut a slot, or groove, the width of the tooth; the edges of the groove are slightly undercut, to retain the wood into position; that end of the groove which approximates to the gum is cut somewhat deeper; consequently, when a piece of compressed wood of equal thickness is slid into the groove, with the fiber of the wood parallel with the tooth, on absorbing moisture it expands, and the pressure comes first on the edge of the tooth, where it can exert the greatest amount of power. When it has pressed the tooth out as far as it possibly can, another and thicker piece of wood is substituted, and so on, until it may be found requisite to fit another bone-piece to the retreating tooth, and continue the same plan.

"The way in which the compressed wood is used for drawing a tooth back, is by cutting a small recess on the lingual surface of the bone-piece behind the tooth to be drawn back. Into the recess is placed the wood, the fiber parallel with the tooth, and over the wood a small piece of gold plate, and over the plate a ligature, passing through holes on either side of the recess. The ligature is then made fast over the tooth, on which the expanding wood now acts. The bone may be left sufficiently deep to prevent the antagonistic teeth from being obstructive, and at the same time mastication is but little impeded, and the incumbrance to the mouth is much less than when spiral springs are used,

and more convenient and less unsightly than when gold bars are brought in front of the teeth. "

James Robinson describes in *The Dental Review*, London, 1859, *"The Causes of Irregularities of the Teeth,"* page 268:

"Irregularities of arrangement can only be properly said to affect the second set of teeth, and are of two kinds, temporary and permanent. The first arises from too rapid an advancement of the permanent teeth before a corresponding absorption of the fangs of the temporary has taken place, so that the former, meeting with an obstruction in their progress through the gums, are forced into irregular and unnatural positions, and pierce the gums either before, behind, or on the sides of the temporary teeth. The permanent irregularity arises from a contraction and malformation of the maxillary bones, in which a deep declivity is usually observed in the arch of the upper jaw, together with the increased size of the permanent teeth, as compared with the first set, and their development before a sufficient growth, or expansion, has taken place in the maxillary bones, to permit of the teeth piercing the gum in a regular manner."

Page 272: "The neglect of removal of the deciduous teeth at the proper period is also a common source of irregularity of the second denture, and one which parents too frequently neglect, by not regularly consulting and placing their children under the care of a dentist; in fact, if parents would only adopt a systematic proceeding with their children, as they do in education, dress, etc., by visiting their dentists at stated periods, we should be seldom called upon to have recourse to our mechanical ingenuity in the arrangement of permanent teeth by mechanical contrivances; and the time is not far distant, we trust, when every well-conducted school and family will have its dental practitioner attached, in the same manner as they have medical men, professors of music, drawing, etc., in which case society would seldom be shocked with the egregious personal deformities, imperfect articulation, and premature loss of one of the most valuable adjuncts of personal beauty and of health."

Page 334: "The too early extraction of the deciduous teeth, before the permanent are sufficiently developed to take their places, is also a cause of serious irregularity; and in some of these cases an irremediable and permanent deformity is produced by the contraction of the alveolus. The growth and advancement of the dens sapientiae, when an insufficiency of space exists for its development, is not only a source of great suffering, but frequently the immediate cause of irregularity by the pressure exerted towards the anterior part of the mouth, which until their development presented a regular denture."

Page 481: "There are some cases of these projecting teeth in which it is advisable to try the results of mechanical treatment, particularly where there exists a well developed arch, and a separation of the teeth. For the treatment of such cases many mechanical contrivances are employed; one consists in striking up a plate, made to extend over and cap the whole of the teeth, from the bicuspids on each side to the second molars. Upon this plate, immediately over the first molar, is fitted and riveted a piece of dentine, of a sufficient height to prevent the usual approximation of the jaws to their former position. On the inside of the mouth the plate extends behind the teeth, being cut away from

the back of the protruding organs; as otherwise it would counteract the effect of a bar that has to be soldered on from the second bicuspid, and extended to the corresponding tooth on the opposite side, which is intended to produce the necessary pressure when the mouth is closed. This bar has to be adjusted and made to fit tolerably tight in front of the projecting teeth, and extends a line or so from their cutting edge.

"As the teeth are pressed backwards, the piece will necessarily become loose; the bar must be readjusted to their altered position, or the intervening space be filled up, by drilling holes opposite the irregular teeth, and fastening on to the bar pieces of India rubber. These appliances answer for a time, but ultimately a new plate must be adjusted to such altered position of the teeth."

Page 482: "The following drawing (Fig. 2) will explain my observations upon this subject, and I will now endeavor to describe the various improvements that have been introduced for the same purpose.

"In cases where the central and lateral teeth had been developed within the dental circle, and it was necessary to exert posterior pressure to force them

Fig. 2.—After Robinson (1859).

outwards, this was effected by fitting a piece of dentine to a model of the anterior part of the palate, and the internal surface of the upper teeth, extending behind the four incisors and canines, beyond which it was carried over the crowns of the bicuspids and first molar on each side, to prevent the usual approximation of the jaws. Immediately behind the irregular teeth was screwed into the dentine pieces of strong gold wire, which were turned and flattened presenting a button-like surface to the posterior part of the irregular teeth, with which they were brought into contact by the approximation of the two jaws. The bone palate was retained in its position either by gold clasps or ligatures of dentists' twists tied to either the bicuspids or molars. As the teeth were pressed outwards the gold wire-studs were lengthened until the cure was completed.

"Very often in difficult cases two or more bone palates were required, and the compressed hickory substituted for the gold stud. These mechanical arrangements answered their purpose, but the cases occupied so much time, and the patient had to be seen so frequently, that I substituted for gold studs, screws and hickory pegs, which exerted a continuous mechanical pressure upon the irregular teeth.

"This consisted of a stout spiral spring made of flat wire, rather stouter

than is generally used for making the ordinary spiral spring for supporting a full set of teeth, but not so closely coiled, and contained in its full length about five to eight turns of the wire upon a mandril the size of pin wire, at the end the wire was bent outwards so as to form a hook, at the other end the coil was contracted. A pin was now made of a piece of sixteen carat wire, upon which was soldered a button of fine gold. The pin was then placed in the center of the spring at the contracted end, and secured by a little pewter solder. The whole was now placed in a gold tube of nearly the same size as the spring. At the side near the bottom a small hole was drilled to receive the end of the coil, which had been bent and made to fit the hole in the tube, and thus secured the spring to the bottom of the tube. A hole of the same size as the tube was now drilled in the bone, which must be left much thicker opposite the irregular teeth, and the tube containing the spring is fastened either by means of a screw or pin inserted into the bone at the posterior part of the tube.

"When placed in the mouth, the button should be pressed backwards in the tube, and then allowed to come forward in contact with the irregular teeth. The piece is fastened by drilling holes on each side in the bone, either opposite the neck of the second bicuspid or first molar, and tying the piece to these teeth.

Fig. 3.—After Robinson (1855).

Whilst being secured the patient should close the mouth firmly on the piece to keep the spring in its proper position." (Fig. 3.)

Page 535: "To the palate and gum is accurately fitted a gold plate, extending as far as the first bicuspid tooth on either side. To sustain the plate in this position, holes are drilled, and ligatures of dentists' twist, or the dried gut of the silkworm, are passed through the holes and fastened to the neck of each bicuspid tooth, or the first molar, if the plate be extended so far. By firmly securing the plate as described, the requisite traction can be exerted in any direction. To obtain this continuous traction it is necessary to coil a piece of gold wire into the shape of a spiral spring, which is to be attached to some point near the posterior margin of the plate, the spring being put in a state of tension by a ligature fastened around the irregular tooth, and secured to the coils of the spring; the other end of the spring is fastened at such a point of the margin of the plate as would give the desired traction by soldering into the plate a piece of gold wire the size of the spring, and turning it at right angles."

Page 538: "A plate of gold is constructed which extends over the anterior part of the palate from the first molar on either side, over the crowns of which the gold is carried, and down to the neck, at the side on which the irregular teeth are situated. A tube of gold is there soldered for receiving a piece of flattened elastic wire, which is rounded at one end to fit the tube, into which it is inserted, and when placed in action it will act as an elastic lever. The wire

should be carried opposite the irregular teeth, the end of the wire should be flattened so as to pass between the teeth at the side to be turned. At the same time, if necessary, the lateral can be brought inwards by either slightly bending the bar opposite the tooth, or fastening on the bar a piece of gum elastic, so as to exert pressure when it is in action upon the tooth. To prevent the approximation of the teeth in their former position, a piece of dentine is riveted on the gold cap at either side. As the tooth is turned, the bar is shortened from the socket end, so as to keep up a continuous leverage until a cure has been effected, and the desired direction obtained."

Page 592: "The most simple to rectify is when the two permanent centrals in the lower jaw are developed wide apart and the laterals advancing posteriorly —the temporary canines still remaining in the jaw leaves no space for their regular development; in such cases the application of the india-rubber ring will be sufficient to bring the centrals in contact—after which a ligature of silk will be all that is necessary to keep them in their position until the laterals are sufficiently advanced to support them.

"In those cases in which the centrals have been developed externally to the dental circle in the lower jaw, and the corresponding teeth at the top close behind them, the following apparatus may be employed.

"Instead of the plate a flat or circular spiral spring or india rubber ring may be substituted; if the former, each end of the spring should be fastened to a piece of gold wire, bent at right angles, and soldered to the outside of the plate on each side, opposite the first molar, and as the teeth are forced inwards the spring is reduced in length, in the same manner as that employed for the reduction of projecting centrals; the shortening of the spring is continued until the irregular teeth are brought behind those in the upper jaw, when the mouth is closed. In cases where the central tooth in the upper jaw approximates behind a central in the lower jaw, and by its malposition forces the lower out of the dental circle, a compound irregularity, it may be said, is produced, as shown in the accompanying figure.

"To meet this case an inclined plane is employed, which will operate for the reduction of both teeth, at the same time a plate is made which should cover two or three of the incisors, and extended to the first molar on each side, capping each of the teeth. The plate is made to line the external and internal surfaces of the teeth down to the margin of the gum.

"Upon the edge of this plate the inclined plane is soldered so as to operate upon the upper tooth when in action. Before its insertion two holes are drilled through the inside portion of the plate, and a piece of stout twist passed through, so as to form a loop, which embraces the irregular lower incisor and secures it to the plate. A ring of vulcanized india rubber will be generally found preferable, by merely substituting a screw pin for the holes on the inside. By this mechanical contrivance we are forcing the center out, at the same time bringing the lower tooth within the circle, and the approximation of the upper in a short period will be over the lower tooth, when the cure will have been effected."

C. N. Pierce, in the *Dental Cosmos* for October, 1859, under *"Regulating the Natural Denture,"* says:

"I would not say that under any circumstances it would be improper to

remove one of these teeth, but I believe, as a general rule, and one acknowledged by all intelligent dentists, they should be preserved, even at the sacrifice of the more posterior ones. The reason for this, in addition to preserving the beauty of the countenance, is the durability of the teeth.

"If young men in the profession would be careful to observe a few things before attempting to remedy malpositions of the teeth, they would save themselves some moments of regret, and probably some censure. (1st) The age of the patient for whom the operation is to be performed. (2nd) The relative durability of the teeth at that age. (3rd) The physical condition of the teeth to be corrected, and the adjoining ones. (4th) The manner in which we have the jaws articulating. The reasons for observing the first three are obvious from what has already been written. The fourth I consider of equal importance; for, if we find irregularity of the upper anterior teeth, with the lower ones occupying their normal position by closing entirely posterior to them, the course to be pursued is quite different from where we have them closing anterior to the upper ones. In the former position, even though we should correct by enlarging the arch, and preserving all of the teeth, we should have the under ones so far posterior to them that it would be almost impossible to keep the upper ones in the regular position to which they had been forced by means of plates, springs, ligatures, etc.; for such is their tendency to fall back into the places assigned them by nature, that the moment our mechanical appliances are removed we should have them fast assuming their former position. I think it might be set down as a rule in practice, that where we find irregularities of the upper anterior teeth with the jaws preserving their natural articulation, it is useless to spread the arch (unless it were both practical and essential to bring out the under ones proportionately to preserve the symmetrical contour of the face) in order to correct the difficulty, but resort at once to the forceps for the purpose of procuring the desired room. If we have irregularities in articulation either complete or partial, then another course of treatment may be necessary."

J. Foster Flagg, page 180 of the November issue, 1859, of the *Dental Cosmos*, stated that the causes of irregularity were hereditary and mechanical; "the hereditary generally affecting the incisors while the mechanical causes influenced the bicuspids, the cuspidati being about equally affected by both.

"The treatment consisted in removing all the second bicuspids, above and below, throwing India rubber tubing ligatures around the six-year molar left inferior, and the left inferior first bicuspid and cuspid, drawing the two latter backward and into the arch, at the same time passing a silk ligature around the lower incisors in such a manner as to force into position an overlapping left central. In the upper jaw a plate was adapted to the palate, secured by silk ligatures to the first permanent molars; pins were placed in the plate in such a manner as to allow of the attachment of two elastic bands, which were secured by silk threads to the central incisors, drawing upon the mesial face; other bands were so arranged as to draw upon each lateral angle of the centrals, passing between the centrals and laterals from their palatine faces, and running along the labial and buccal faces of the teeth unto the first molar of either side; tubing was thrown around the remaining superior bicuspid of either side

and the molar, for the purpose of approximating these teeth, thus affording space for the proper placing of the irregular centrals."

E. C. Angell. (Through some mistake the article reprinted from the *San Francisco Medical Press* in the *Dental Cosmos,* the initial "C" was changed to "H" and printed as E. H. Angell.) In the April, 1860, issue of the *San Francisco Medical Press,* page 83, and the July issue, page 145, Angell contributes several advanced, as well as remarkable, ideas in regard to correcting irregularities of the teeth. The same idea has recently been reintroduced by several men as the "rapid separation of the maxillary suture."

Angell emphasized the importance of the first permanent molars, being the first to note the eruption of these teeth, their importance, and the necessity of their retention, as well as all of the permanent teeth in order to establish "correct occlusion of the teeth."

He describes first the eruption of the various teeth in the permanent set, and the approximate age of their eruption. This was probably the first time on record that anyone advocated the opening of the median suture to provide space in the dental arch in order to establish occlusion. He describes in detail the various steps taken to accomplish this end and the appliance used, namely, the jack-screw.

"These teeth, four in number, are the first of the permanent set to take their position in the mouth, and are usually developed and admirably articulated before any of the primary teeth have fallen from their sockets. Nature has thus in her munificent wisdom, provided a sure and unerring guide, to the correct occlusion of the jaws, despite the loss of the deciduous set. By the presence of these organs, correct articulation is preserved; while without them, there is no security against deformity and distortion of the features. At the early period at which these teeth are permitted to be destroyed, the inferior jaw may incline to either side, or instead of staying in its place, may assume the deformed position, denominated underhung; in which the inferior incisors shut outside the superior. The distortion of face, and ugliness of countenance, resulting from the early loss of these teeth, would severely tax the science of mathematics to compute.

"One of the modes of treatment frequently employed when these teeth begin to make their appearance, and it is ascertained that there is not adequate space for them to occupy, is to remove them as soon as they can be taken hold of with the forceps, and thus deprive the mouth of two of its most ornamental, and at the same time, most serviceable organs. Another is the removal of the first bicuspids, and the employment of pressure to bring the cuspidati into their places; and still another is the removal of the second bicuspids, when the first are moved back, and the cuspidati, as in the former instance, drawn into the arch.

"If the teeth are sound, and I am to treat this class of irregularity, and have the case in charge as soon as the cuspidati have made their appearance, I employ neither of the foregoing methods; but by an apparatus simple and efficient, proceed at once to widen the jaw, and expand the maxillary arch, so as to admit the teeth to the place nature intended them to occupy. The time necessarily involved in this expansion at the age above indicated, by the ap-

paratus in question need not exceed two weeks; after which it is only necessary to preserve the space secured until the complete eruption and development of the teeth in question.

"The opinion seems to have become almost universal that the extraction of one or two of what are usually called back teeth is a matter of no moment so long as the vacancies are not discovered in opening the mouth, yet to remove these one or two, is to remove the keystone of the arch, and is generally the beginning of the undermining of the whole denture. The loss of one of these teeth from either side is not the loss of one tooth merely, for the destruction of the opposing organ will ordinarily soon follow. In the occlusion of the jaws, nature has provided the teeth and their sockets with the ability to resist the no inconsiderable pressure exerted upon them by the combined action of the several muscles employed in mastication. To remove one tooth, therefore, is to remove its antagonist from the influence of this muscular action, and, as a consequence, it continues to protrude further and further into the mouth, until it has little or no socket to sustain it. Nor is the protrusion and consequent loss of the articulating tooth the full extent of the injury resulting from

Fig 4.—After E. C. Angell (1860). Illustrating perhaps the first method of separating the suture.

this first extraction. The time-honored theory of the ancients, that 'nature abhors a vacuum,' would seem to be fully demonstrated in the effort of the teeth on either side to come to the rescue and heal the breach. To such an extent does this approximation occur, as often to annihilate the spaces in the posterior portion of the mouth, and generally at the expense of the teeth more anteriorly situated, so that the spaces, the idea of which would so much horrify, have come though ever so unwelcome. From the extraction of a second superior molar, it is not uncommon to find, months after, its place partially occupied by the first molar, and a corresponding retreat of the bicuspids and cuspidati, leaving sufficient space between the latter, and the lateral incisor, for an additional tooth, giving the same impediment to articulation and impairing the expression of the face as effectually as would the extraction of one of the anterior teeth. If, therefore, the adult has been so unfortunate as to suffer the loss of a first or second molar, its place should be skillfully supplied to secure the remaining teeth in their respective positions.

"For this purpose I adapted to the lingual surface of the bicuspids of the right side, collars of gold, with linings of pure gold, that the contact might not injure the enamel. To these collars, which united between the teeth, was

soldered the tubular nut marked *A*, Fig. 4. The thread in the nut was sufficiently extended to prevent any rocking motion. On the left side, similar collars were not admissible, as the first bicuspid could not be moved outward without moving the cuspidatus further out of place. I therefore adapted to the second bicuspid a clasp similar to those usually employed for retaining plates supporting artificial teeth. By means of the latter, which, like the collars, was lined with pure gold, the fixture was prevented from sliding during mastication. To this clasp was soldered a second tubular nut, differing only from the first in having a left hand thread. The threads on the shaft marked *D*, were cut to correspond with the nuts. The middle of the shaft was made square, to which was fitted the key or wrench, as seen in diagram 3 (Fig. 8). This was made from a dime, the silver being strong enough to turn the shaft, without being hard enough to bruise it.

"This apparatus was placed in the mouth, when the shaft was made to revolve until the fixture was made comfortably firm; when the patient was provided with the key, and instructed to keep the shaft as uniformly firm as possible. Those directions were industriously followed, and at the end of two

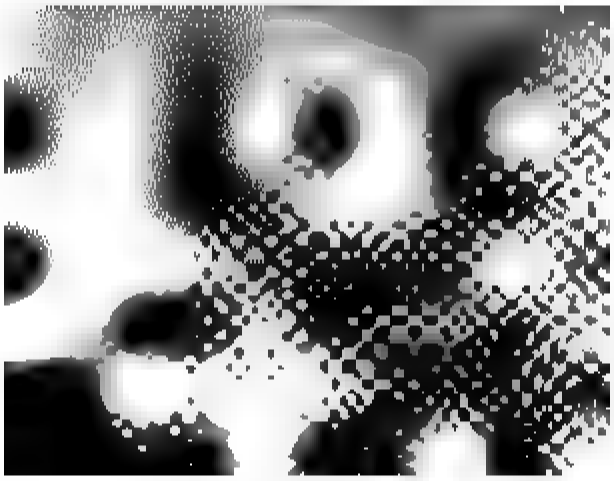


Fig. 5—After E. C. Angell (1860).

weeks, the jaw was so much widened as to leave a space between the front incisors, showing conclusively that the maxillary bones had separated; while the left lateral incisor had been brought completely outside the inferior teeth. The plate (as seen in Fig. 5) was next adjusted to the mouth, the molar and bicuspid of the right side having been moved apart, so as to admit a clasp adapted to the molar. A collar was extended from the plate to the posterior proximal surface of the lateral incisor. A nut was soldered to the plate, at the point near which the collar was attached, through which a smaller shaft, having a thread corresponding to the nut, was made to revolve. To the opposite end of this shaft was affixed the common chain swivel, to which was soldered the original clasp, affixed to the extremity of the first shaft.

"The maxillary arch being sufficiently widened, the next step was to move the bicuspids posteriorly, until sufficient space had been secured to receive the cuspidatus. This apparatus was placed in the mouth, and the patient again provided with the key, and instructed to apply it often enough to keep up a uniform pressure. In this instance we had a larger resisting surface than in the former; consequently our progress was slower; besides the patient was kept at home for a time from a severe indisposition induced by an epidemic, preva-

lent at the period. My impression, however, is, that the second bicuspid might have been moved sufficiently for our purpose in two weeks, without difficulty, or causing any material inconvenience to the patient. The first bicuspid followed of its own accord a part of the distance.

"The rotating shaft was now removed, and a spring was soldered to the plate at the point to which the nut was originally affixed; and from which it extended, so as to press upon the anterior proximal surface of the first bicuspid, as seen in Fig. 6. This spring in a few days moved this tooth so as to leave sufficient space to receive the cuspidatus. The original collar adapted to the

Fig. 6.—After E. C. Angell (1860).

posterior proximal surface of the lateral incisor was extended and curved so as to press upon the labial surface of the cuspidatus, and within a week from this application we had the satisfaction of seeing it within the arch it was originally intended to occupy.

"To the best of my knowledge, this is the first instance in which an apparatus of the character in question has been employed for correcting irregularities of the teeth. At the Annual Dental Convention assembled in Boston in 1857, Dr. W. H. Dwinell, of New York, spoke of the employment of the 'simple screw and nut, in conjunction with plates,' for the correction of irregular teeth.

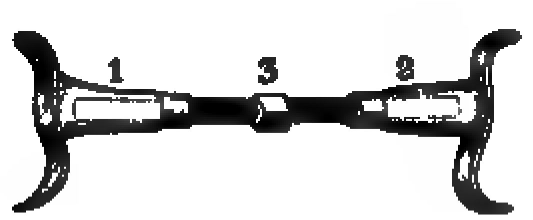


Fig. 7.—After E. C. Angell (1860).

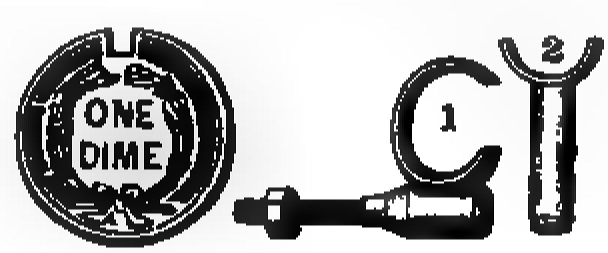


Fig. 8.—After E. C. Angell (1860).

He also stated that he had met with great difficulty in making fixtures that were strong enough, while they were sufficiently small to be practicable, until he had employed steel screws, with zinc attachments to prevent rust. In using the simple shaft as employed in the foregoing case, independent of any plate, there is no difficulty in making the apparatus of sufficient size and strength to widen the maxillary arch of even an adult. The shaft in question was made from sixteen carat gold wire, No. 13, according to Stubbs' gauge. Finer gold may be used: for instance, that alloyed with platinum as usually employed for

clasps; but this is inferior to the first, as its hardness renders the cutting of a good and perfect thread more difficult.

"I have since employed the same style of apparatus with equal success in correcting irregularities of the incisors when they overlap each other. For this purpose I employ an apparatus as represented in Fig. 7. The collars at either extremity are intended to rest upon the palatine or lingual surface of bicuspids, when the wrench is applied to the shaft as already described. In these cases it is only necessary to secure sufficient space, when the irregular teeth may be turned in their sockets without difficulty, and may be as easily fixed in correct positions. When the cuspidati are both outside the arch, and the patient is not too old, so as to render the treatment impracticable, the apparatus should have a single collar at each extremity, as seen in Fig. 8-2, which represents a tubular nut with collar affixed.

"These collars should rest upon the palatine or lingual surfaces of the second bicuspids, as the first can not be moved outward without augmenting the difficulty sought to be corrected. When the arch has been sufficiently widened, the first bicuspids may be moved posteriorly by the apparatus exhibited in Fig. 8-1, the nut through which the shaft revolves being soldered to a plate adjusted as described in Fig. 5. When sufficient space has been secured for the admission of the cuspidati, they may be brought into the arch as already described.

"The uniform and gradual pressure exerted by this apparatus can not fail to commend it in the strongest terms for correcting the general irregularities of the teeth. It offers but little impediment to articulation, and the ease and rapidity with which it accomplishes the work is as gratifying to the patient as it is satisfactory to the operator."

The Editor of the *Dental Cosmos,* May, 1860, in reviewing the above article doubted the feasibility of the rapid separation of the suture and in the light of our present knowledge it may be of interest to those who are following this history.

"We are pleased to have an opportunity of presenting it to the readers of the *Dental Cosmos,* as there are several valuable suggestions in it; but must beg leave to differ with the writer in the conclusion arrived at, that by the use of the apparatus described he succeeded in separating the superior maxillæ from each other. With no disposition to assert that such a thing is utterly impossible, yet, when taking into consideration the anatomical relations existing between the right and left superior maxillæ and the other bones of the face with which they articulate, such a result appears exceedingly doubtful. Even admitting the impression of the writer to be correct, it would be a very strong argument against the use of such an apparatus; for surely the irregularity of the teeth is a trifling affair compared with the separation of the maxilla, which could not take place without inducing serious disturbance in the surrounding hard and soft parts. Doubting the possibility of effecting the separation, we can see no objection to the employment of the apparatus, and indeed believe that it will be found very useful in correcting many cases of irregularity."

J. H. McQuillen, page 170 of the *Dental Cosmos,* October, 1860, in reviewing this article, says:

"With due respect to the opinions of the dental as well as general surgeons

of no 'inconsiderable eminence,' who appear to have been perfectly satisfied by merely examining 'the models of the case,' that the maxilla had been separated, and with no disposition to question the veracity, much as we may differ in opinion with the writer, we would take the liberty of stating that such evidence, however satisfactory it might be to others, would be insufficient to us. We should desire to examine the mouth and pass a finger along the roof, and expect to find, if an actual separation had taken place, the palate not merely reddened, but quite soft along the raphé. In addition to this, on grasping the right and left superior maxilla between the thumb and forefinger on each hand, we should expect to find them quite loose; and, according to the direction in which the force might be applied, whether inward or outward, that they could be brought together or separated.

"Although the writer regards the separation of the maxillary bones as a matter of the highest moment in this branch of dental surgery, and predicts his opinion, that he succeeded in accomplishing it, upon the fact that the central incisors were separated when the force was only applied to the bicuspids; it is not difficult, when taking into consideration that the alveolar process contained by far the largest proportion of organic matter of any other part of the osseous system, to account for the space obtained—three lines, or one-fourth of an inch between the bicuspids, and one line or one-twelfth of an inch between the central incisors—by attributing it to the yielding character of the process. If a separation of the bones had taken place, it is reasonable to infer that the space gained between the incisors should have been equal to that of the bicuspids."

Robert Hepburn, British Journal of Dental Science, 1862, in a lecture on *"The Correction of Irregularities of the Teeth by Mechanical Means,"* says:

"On the Mechanical Treatment of the Irregularities of the Teeth.—On the wide field of dental science there is no subject more interesting, none in which the knowledge of anatomy and surgery, combined with mechanical skill, is more required, none which depends so much on the judgment and patience of the operator for a successful result, and none where the lack of these requirements is so likely to produce serious and lasting injury to the patient.

"I have already said that many of the cases we daily meet with may be fairly attributed to neglect when young. I may now add that many others may be traced to maltreatment at the hands of inexperienced men, ignorant alike of the structure of the teeth, of the mechanical contrivances necessary for the correction of irregularities, as well as that anatomical knowledge so requisite to guide them in their timely and judicious use. It is an old and true adage that 'prevention is better than cure.' While superficial skill may in some instances enable you to effect a cure, I wish to impress this fact upon your minds, that a deeper knowledge will ensure that which is better still, viz., the prevention of the evil your skill might only chance to cure.

"The first and certainly most simple appliance used for regulating teeth was the ligature of thread, which was subsequently changed for gold wire, finely drawn and very soft. With these ligatures it was intended to draw the irregular teeth into their normal position, by interlacing and binding them to the stronger and more regular ones.

"In the construction of these appliances there are several requirements, which, if not absolutely essential to their success, nevertheless materially assist in securing it. The first of these is simplicity of form and action. We may construct a most complicated piece of mechanism, of delicate workmanship, highly finished, beautifully articulated, and altogether looking exceedingly pretty on the model, every little spring having its own particular action, and every little plug its duty to perform. When placed in the mouth, however, the slightest movement turns every little spring and plug out of place, all the nice adaptations being thrown to the winds, while the instrument itself is wholly unfit to stand the wear and tear of mastication, etc. Do not allow yourselves to be carried away by fanciful pieces of work, which in theory and on a model look well, but are unfitted for all practical purposes in the mouth. Let your aim be to secure simplicity of form and directness of action, as essential characteristics of a good regulating piece.

"Next we have fixedness, or the capability of being steadily secured in place in the mouth. If the piece can not be made to retain its position, our efforts to secure simplicity of form and direct action will be in vain."

H. Meredith White, in the *Dental Cosmos*, June, 1862, page 578, on *"A Case of Irregularity of the Teeth,"* says:

"The following case of irregularity presented in April, 1859. The patient was in his twentieth year, and in good health:

"The right superior lateral incisor stood entirely within the arch of the lower jaw. The left superior lateral struck upon parts of the left inferior median and lateral incisors, and, by the constant friction to which it was exposed, had been so much worn on the cutting edge that the dentine could be seen between the anterior and posterior plates of the enamel—on this account it was shorter than the lateral of the right side.

"The arch of the upper jaw was nearly as small as that of the lower, and the spaces that the laterals should have occupied were but half sufficient for their accommodation.

"In regulating these teeth, two things were to be accomplished: (1st) To enlarge the arch. (2nd) To place the irregular teeth in their proper places. These two steps were accomplished at the same time. As the labial surfaces of the laterals were somewhat round, resembling canine teeth, it was evident that by forcing the teeth forward they would act as wedges, and widen the arch, and at the same time would gain their proper places. By the aid of inclined planes, one for each lateral adapted to a plate fitting the under jaw, this was gained. In addition to this a plate was made for the upper jaw, having crib-bands for the first and second bicuspids of each side, and a bar to run around in front of the upper arch, standing away from the labial surfaces of the teeth about an eighth of an inch, and soldered to the crib-bands; patent thread ligatures were secured to the necks of the laterals, and the ends drawn tightly around the bar and tied. These ligatures were renewed every three or four days so as to keep up a continual traction. The inclined planes were worn continually, thus making them powerful auxiliaries; in the mean time, by propping the teeth apart about a quarter of an inch, they allowed the laterals to slip over the lower teeth.

From time to time the bar of the upper plate was lengthened by placing it over the arm of a small anvil, and striking it with a small riveting hammer. This was done to make room for the teeth as they advanced. The central incisors were coming forward at the same time, and increasing the size of the arch.

"After pursuing this course for three months the teeth had arrived at their proper places. The inclined plane and the plate with the bar were now dispensed with; but now a new plate for the upper arch was made, with pieces fitting against the back parts of the four incisors, in order to prevent retrocession or turning of the teeth. This plate was worn nearly two months, so as to give the teeth sufficient time to become firm in their sockets. The plate was then left off, there being no further use for it. The teeth were regular, and looked very well; but the shortness of the left lateral, referred to above, was objectionable.

"I tied very tightly a patent thread ligature around the neck of the short tooth, and under the free margin of the gum. I saw the patient in three days, and observed that the tooth projected from its socket to a slight extent. The ligature was still retained, and the patient was seen again in three days. The tooth had already lengthened sufficiently; there was considerable irritation and some pain. The string was removed, and the patient directed not to use that side of the mouth for several days, and occasionally to apply a little pounded ice in a rag to the gum above the tooth, and to return in a week. The patient came as directed. All irritation had subsided, and the tooth had shortened, but not to its original state.

"By practicing this treatment every alternate week, so as to give the tooth time to recover each successive shock, the end was accomplished in six weeks. The tooth is as long as its fellow of the other side, and after having its rough edges dressed off, presented a good appearance.

"It has now been over two years since the affair was concluded, and so far no ill effect has arisen from this novel plan of lengthening teeth, which has been very successful in the hands of him whose advice I followed.

"It may be proper to add that during the first fifteen days of regulating teeth, by means of any apparatus, there is always more to fear than during the subsequent treatment, since violent periostitis is apt to occur, and if it does it is more difficult to treat, and more destructive in its consequences than apparently the same amount of inflammation occurring during the treatment of a case of irregularity that has been under way for a longer time."

THOSE WHO DESTROY AND THOSE WHO RECONSTITUTE

By Dr. Luis Subirana, Madrid, Spain.

Professor of Orthodontia in the School of Dentistry of the University of Madrid.

ORTHODONTIA, in Spain, as well as Europe, is in such a rudimentary state of development that the writer feels that, even though he reach an extremely old age, he would not see this splendid branch of medicine enjoy its due, social and scientific prestige, consideration and respect necessary for its physiological transcendency in all classes profane and medical, as well as dental. The indifference and ignorance in both classes is so great (it concerns the one because it is to derive the benefits of orthodontia, the other because it is to contribute to the attainment of this object, since the highest mission of the doctor and dentist is to care for the health of humanity) that numberless evils are produced. We say numberless, because we continue to think that the moral and intellectual qualities in man arise in the physical structure and we adjudge to the mouth the greatest vegetative importance for its organs, function and surroundings.

The clinic, the greatest teacher, affords us every day occasions to appreciate the rudimentary state in which orthodontia really is and what it signifies. Today it is the colleague who recommends "not to undertake the regulation until the child is perfectly developed." (These words are repeated so very frequently, that, of course, the professional ethics remain miserably mistreated.) Again, it is a doctor who orders a six-year molar extracted. The other day it was a father who permitted the mutilation and extraction of one or two of his son's teeth in order to have the teeth arranged in harmony.

The case here presented is highly instructive. The child was operated upon in a French town for some growth. In spite of the ablation, the child continued to breathe through the mouth for some months after. Following the advice of the rhinologist, the child was taken to a dentist in Paris and he proposed the correction of the dental range. For the first step he proposed and executed the extraction of the left lower lateral incisor. The following day he was to extract the upper lateral incisor on the same side, which is seen in infra-linguoversion (Fig. 7). The maternal instinct saw a blunder or error in what had been done and proposed by the dentist. Although the one tooth was gone, and no remedy possible, there was still time to save the other. New consultation with the rhinologist. . . .

The girl was eleven years old. She was nervous, extremely sensitive, dull and faint looking. She had a depressed thorax, slant neck, pale face, very thin generally, and had mouth breathing. In criticising the procedure, let us say, as Angle, according to his definition: "Orthodontia is a science, the object of which is to correct the malocclusion of the teeth," and without pretending to excel the great professor, we are going to amplify it, saying: "Orthodontia is that science which, defending the right of the dental system, contributes to the

harmonical development of the face, and of the organs integrating it, wholly and regularly assisting the functions of the mouth."

We do not pretend in this article nor at this time to advance a new definition, but simply to explain, and facilitate the comprehension of our successive arguments.

If what Angle and we say is true, and in fact it is, all men who, in order to correct the teeth extract them, continue to separate themselves from the

Fig. 5.—Model of the mouth before the correction. Notice that the central and left canines are intact. The lateral one is in the palatine arch.

Fig. 6.—Models of the mouth after correction. The occlusion is perfect. The left superior lateral stands in a right line. In the model one may see the space obtained to secure the corresponding length of the arch; a space which will be occupied by a false tooth, rectifying the harm caused by the extraction.

noble aims of orthodontia the more they extract, because orthodontia is not that sum of operations, manipulations, opinions, and personal subjective thoughts, which have for their object the adjustment of a few stray teeth in the mouth. Orthodontia is something much more serious. It is something that does not permit personal interpretations. A malocclusion is not a disputable thing. Orthodontia has its canons, its laws. It is a regulated and measured thing, and he

who forget's nature's institutions goes directly against the aims of orthodontia.

In the philogenical regulation man has 32 teeth. The orthodontist's duty is to respect this sacred accommodation for the necessities of man. He who injures them, betrays this duty, more than that, he makes the first step of

Fig. 7.—Occlusal surface before the correction. Fig. 8.—Occlusal surface after the correction.

Let us compare the enlargement of the palatine and dental arches with their symmetry In Fig. 7 one sees the lateral incisor in intraversion, rendering difficult phonation In Fig. 8 it is seen in its anatomical position.

Fig. 9.—Occlusal surface after correction. Fig. 10.—Occlusal surface before correction

More than one centimeter of enlargement was secured which has afforded the tongue a "lodging" in proportion to its size. Fig. 9 shows the space secured for the lateral incisor

individual degeneration, which, if continued during successive generations, will corrupt the species.

When a child, having a malocclusion, comes to our consultation to have

some dental relation corrected, he does not come to have the number of teeth corrected. *The orthodontist is the guider of deviations, not a surgeon to cure by maiming.*

The blood and wound should be proscribed to the orthodontist. The orthodontist is the orthopedist who, realizing the inestimable value of the living matter corrects, modifies and reinstates the functional integrality within the anatomical integrality. The numerical dental formula is a sacred collectivity that should merit the highest respect and honor because it represents a definite length by a sum of antero-posterior diameters; because it represents an adequate and proportional form of the arch with all of the organs which come in contact with it; because it represents, through the size, relation, and form, the exact, precise, and harmonical limit for the phonation, mechanics of digestion, the harmony of the facial lines, and the *maximum* functional excitation.

Now my old colleagues of controversy of the Odontological Society in the years 1899 and 1900 will understand the reason of our furious protest, predicted, rather than rational, when a person of authority pretended to present as the best therapeutical law, as the prophylactic panacea of I-don't-know-what, the extraction of the six year molar. Today would there be any heretic capable of rising to defend such a theory?

What would we say of a doctor, who, upon having a child, with a deformed leg come to him, would order the leg amputated instead of prescribing reconstituents and orthopedic therapeutics. It is the same case.

A malocclusion is neither an illness nor a wound; it is an anomaly. It is a perversion of a union of the organs in geometrical solidarity. It is a system accidentally out of order, and its normal state must not be secured by the suppression of one of its elements, factors or its unities.

Therefore, our method of procedure was contrary to the former one. It was necessary to preserve the superior lateral. It was also necessary to enlarge, to space the lower teeth, and to obtain a space of equal diameter to the extracted lower tooth, in order to insert a false one. Without this requisite, orthodontia would not be possible. Only with orthodontia could "normal occlusion" be obtained the basis of coordination and correlation, and anatomical harmony of all the muscles and bones that are below its statical and dynamic dependency. We do not pretend to speak of the technic followed in this correction and of the other considerations, which will be given the proper space. We have simply endeavored to show with this case the necessity of preserving the number of teeth, a point so essential in orthodontia.

STEREOSCOPIC PHOTOGRAPHS AS ORTHODONTIC RECORDS

By H. C. Pollock, D.D.S., St. Louis, Mo.

STEREOSCOPIC photography is not a new art, in fact, it is a very old principle applied to photography. However, it has only recently been applied to x-ray records of the examination of anatomical specimens.

The use of this type of photography may prove of interest to many orthodontists, as to the author it has been a source of considerable satisfaction and interest.

This type of photographic record is more complete, thorough, and satisfactory from an orthodontic standpoint because the object is seen in perspective relief. In the ordinary vision the respective images of an object formed upon the retinas of the two eyes differ slightly, due to the divergence of the rays from each point of the object, but the effect upon the brain is that of a single object seen in perspective relief. The monocular image lacks this effect. Observed through the stereoscope, two pictures, taken under a slight difference of angular view, are seen side by side, each eye looking upon one picture only; thus, as in ordinary vision, two images are conveyed to the brain where they are united into one, exhibiting the objects represented under a high degree of relief.

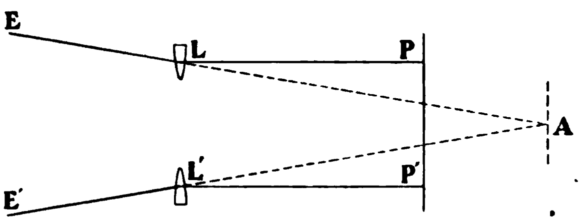


Fig. 1.

The principle employed is based upon the refractive properties of a semi-double convex lense. The action may be illustrated by diagram (Fig. 1). The light rays from corresponding points of the two pictures (P and P′) are refracted in passing through the lenses (L and L′), and their directions changed so that they now seem to the eyes (E and E′) to diverge from a common point (A) beyond the plane of the card. By special effort a skilled observer can combine stereoscopic pictures into one without the use of the instrument, each eye being directed to one picture only, and, to produce the stereoscopic effect, the one on its own side. The process may be facilitated by interposing a card screen between the pictures, so that, for example, the left picture will be entirely cut off from the right eye. If the eyes are crossed so that the right eye sees the left picture and the left eye, the right picture only, and the images combine by special effort, the usual stereoscopic effect is reversed, a convex surface becomes concave, etc.

In order to get the stereoscopic effect of the accompanying photographs, it will be necessary to cut the picture out of the Journal at the edge of the heavy black line, and place it in any ordinary old-fashioned stereoscope, as shown in Fig. 2.

Fig. 3 furnishes a beautiful record of a typical tongue habit, causing the protrusion of the upper anterior teeth. This picture, when seen through the stereoscope, shows very plainly the tongue resting against the lingual surfaces of the upper anterior teeth and slightly protruding between the upper and lower teeth as a result of the pressure behind it.

Fig. 4 shows the record of a case of fatty frenum. It will be observed by placing this picture in the stereoscope that the anatomy is almost as well shown as in the patient's mouth direct.

Figs. 5 and 6 show other records of various types of malocclusion which

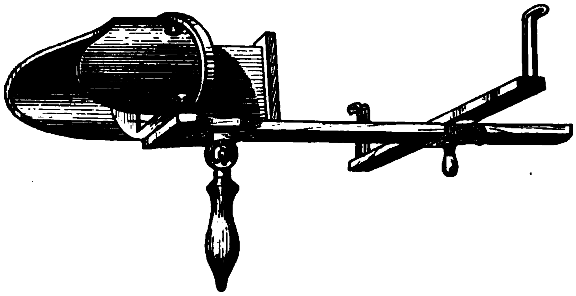


Fig. 2.

make very interesting studies to refer to while the case is under active treatment.

Fig. 7 shows the possibilities of photographing the interior of the mouth. By careful and painstaking technic the occlusion of the teeth may be photographed as far back as the second molar.

The author is deeply indebted to Dr. C. A. Vosburgh, of St. Louis, whose vast experience in the photography of the wild animal life of New Brunswick, stereoscopically, has enabled him to develop the proper technic very rapidly. Having once attained this skill, it becomes only a matter of a few minutes to take these pictures at the chair.

Fig 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig 7

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

James David McCoy, D.D.S., Editor
Los Angeles, Calif.

INDICATIONS FOR THE USE OF THE X-RAY IN ORTHODONTIA

By James David McCoy, D.D.S., Los Angeles, Calif.
Professor of Orthodontia and Radiography, College of Dentistry, University of Southern California.

IT is no longer necessary to present an argument in favor of the use of the x-ray in any of the various branches of dentistry, as its merits and possibilities are now recognized by all openminded and progressive members of the dental profession.

Orthodontists were among the first in the profession to recognize the valuable aid to be gained through the adoption of this agent as a regular part of office routine, and as a result, many of the uncertainties and perplexing situations incident to orthodontic practice have been clarified.

That the orthodontist should maintain his own x-ray laboratory is no longer a debatable point. With it he is able to utilize the x-ray whenever the necessity for its use arises, without subjecting patients or himself to the inconvenience or added expense incident to referring them to a roentgenologist; and what is even more important, *with it conveniently at hand, he will use it whenever indicated, instead of limiting its use to cases of dire necessity.*

It is only logical, therefore, to assume that *an essential part of the preparation of the student or practitioner, who is to undertake Orthodontic procedures, will include the basic principles of radiography,* which entails a knowledge of the nature of the x-ray, the electrophysics of its production, the intelligent handling of x-ray apparatus, the technic of radiography, the development of plates and films, the interpretation of radiographs, as well as a knowledge of the dangers arising through the misuse of the x-ray.

Taking it for granted that the reader is thus prepared, it will, therefore, be unnecessary to discuss here any phases of the above enumerated principles, other than touching upon a few practical suggestions in technic of special significance to the orthodontist.

Owing to the fact that patients undergoing orthodontic treatment are usually children whose ages necessitate their being handled with tact and gentleness if confidence is maintained, precaution should be taken to rid every operation of fear

or discomfort. Especially is this essential in making radiographs, for any considerable degree of movement on the part of a patient will either curtail the value of the finished radiograph, or perhaps render it useless.

THE QUESTION OF TECHNIC.

To obtain a radiograph of any portion of the body, it is necessary to have a photographic or x-ray plate or film (properly prepared so as to exclude all light and moisture) placed in such a position that the x-rays may pass through the desired structures and register their shadows with the least amount of distortion possible upon the plate or film.

In securing radiographs of the dental and oral structures, two general methods of procedure are open to us, each of which has its value and special indications. These are known as the "intra-oral" and "extra-oral" methods.

With the first named, small films are used, which are placed within the mouth opposite the area to be radiographed, and held in position either by means of a film holder, or by the assistant, or better still, by the patient exerting slight pressure with the finger. *This method is indicated when radiographs of small areas only are desired; as, for instance, two or three teeth, with the adjacent alveolar process.*

With the other method of procedure mentioned, namely, the extra-oral method, large plates or films are used, and the areas desired are brought in as close contact as possible with the plate, by pressing or resting the side or portion of the face in which the structures are located against it. The rays are then passed through the structures from the other side of the skull, in such a manner as to cause the shadows of the desired structures to be imposed upon the plate. By using this method, large areas may be radiographed, which in some instances, will embrace the lateral half of both the upper and lower jaws from the region of the lateral incisors anteriorly to the angle of the jaws posteriorly, and from the floor of the orbit above to the inferior margin of the mandible below. In fact, it is possible, by making several exposures, to obtain in detail a radiographic representation of the dental apparatus in toto, as well as its associated organs and structures, the nasal cavity, pneumatic sinuses, the maxilla and mandible.

In selecting a method of procedure for making radiographs of children, the child's comfort must be taken into consideration, and with this idea in mind, the author has found it an advantage to use the extra-oral method quite universally. In fact, he has used it in nearly all cases except where the region embracing the upper anterior teeth is under scrutiny. The wisdom of this course will be apparent to anyone who has experienced the discomfort of having intra-oral films placed lingually to the lower teeth, where the tissues are very sensitive, or has had them placed back in the molar region, against the palate, where they so frequently induce gagging. These unpleasant features are all eliminated by using the extra-oral method, and good radiographs of the structures desired can be secured on the larger plates. This statement should not be construed as a protest against the use of intra-oral films in dental radiography, for it is very often necessary to use such films with adult patients where a high degree of detail is essential, in determining the condition about nonvital teeth, root canal fillings, etc. In orthodontic practice, however, where we are dealing with young

subjects entirely, a sufficient degree of detail can be obtained in the majority of instances, using the extra-oral method to satisfy the needs of the operator.

SEATING THE PATIENT.

In preparing the patient to be radiographed, it is important that a suitable chair be provided, which will afford ample support, not only for the head, but will make it possible for the patient to be sufficiently comfortable to remain quiet, without difficulty. For this purpose, the dental chair may be used, or if this is not convenient to the x-ray apparatus, the ordinary armchair with a headrest may be utilized. The author has found it an advantage to use the ordinary chair with a straight back and small arms, placed against the back of the dental chair. (See Fig. 1.) The headrest of the dental chair is turned over and adjusted to the proper height, position and angle to support the

Fig. 1.—Showing the manner of arranging a chair for seating the patient, and providing a support for the head. Where the "extra-oral" method is being used the headrest wings serve as a plate-rest.

patient's head. If the extra-oral method is being utilized, the headrest wings are flattened out to make a resting place for the plate. In this way, the patient's head is afforded the firm support of the heavy dental chair, and the plate is held in an immobile state without difficulty, and the operator can, by making a few changes in the position of the small chair, and by moving and readjusting the headrest, have radiographic access to any part of the dental structures. (See Figs. 2, 3, 4, 5, and 6.) The fact that this requires but a few moments, does not disarrange the office, or put the patient to discomfort, justifies the author in feeling that it is an excellent method for use in the dental office. Of course, it is necessary where this method is followed, to have the x-ray machine and accessory apparatus in the same room with the dental chair. Where this is not possible, it is an easy matter to attach an adjustable headrest to the ordinary straight-back chair, and by having the patient change positions in the chair, accomplish the same result.

Fig. 2.—The patient is seated and the apparatus arranged to make a radiograph of the left side. Fig. 3 shows the extent of the radiograph made by this technic.

Fig. 3.—Radiograph made by utilizing the technic shown in Fig. 2. The radiograph reveals the fact that the bicuspids and permanent cuspids on the left side are present, but that there is a congenital absence of permanent molars.

Fig. 4.—The patient is seated and the apparatus is arranged to make a radiograph of the right side. Fig. 5 shows the extent of the radiograph made by this technic

Fig. 5.—Radiograph made by utilizing the technic shown in Fig. 4. The radiograph reveals the fact that the bicuspids and permanent cuspids on the right side are present, but that there is a congenital absence of all the permanent molars except the lower first.

INDICATIONS FOR THE USE OF THE X-RAY BY THE ORTHODONTIST.

The necessity for using the x-ray in orthodontic practice, varies with different patients, but generally speaking, may be summarized under ten different headings as follows:

1. *As a means of determining the presence or absence of unerupted permanent teeth before treatment is started.*

The majority of patients requiring orthodontic treatment usually have a mixed dentition; that is, they usually have present in the mouth, the deciduous molars and cuspids. It is essential, therefore, to determine whether or not these deciduous teeth all have permanent successors. If the upper and lower incisors have erupted, information concerning the other permanent teeth is easily obtained, by making a radiograph of each side by the extra-oral method. Such radiographs are shown in Figs. 3 and 5.

Fig. 6.—Where "intra-oral" radiographs are desired, the headrest is arranged so as to support the patient's head.

Such radiographs give the operator a very adequate survey of these unerupted teeth, and leave no doubt as to their presence or absence.

2. *As a means of determining the approximate size of unerupted teeth, for which space must be made in the arches.*

Where the deciduous molars or cuspids have been lost prematurely, with the usual resultant loss of space in the arch involved, the radiograph can be made to show quite accurately the amount of space which it will be necessary to establish, if adequate space is to be prepared for the unerupted teeth. (See Figs. 7, 8, and 9.)

3. *To determine the state of development of unerupted teeth which are tardy in their eruption.*

Not infrequently permanent teeth fail to come through when expected. By

Fig. 7.—Unerupted lower second bicuspid for which room must be made to permit its eruption.

utilizing the radiograph, their degree of development is easily determined, and often the cause for their noneruption is determined. Steps can then be taken to open up spaces, and hold them until such a time as the teeth involved progress in their development to the point of eruption. (See Fig. 10.)

4. *To determine the approximate direction in which teeth are erupting, and the relationship which they will have to the line of occlusion when erupted.*

Fig. 8.—Unerupted upper cuspid for which space must be made if it is to erupt in its normal position

Fig 9. Unerupted lower lateral incisor for which space must be made.

Fig. 10.—Unerupted lower second molar which is prevented from erupting through impaction against the lower first molar

Where the deciduous teeth have been retained in the mouth longer than their normal period, and where the roots of these teeth have not been entirely absorbed, the erupting permanent teeth will sometimes be deflected out of their normal course. It is an advantage to know the direction in which they are deflected, so that if retaining appliances are to be placed, they may be arranged in such a way, and in such a relationship to the erupting teeth that they will not interfere with them. In fact, it is sometimes possible to construct the retainer in such a way that the tooth which is deflected out of its

Fig. 11.—Unerupted upper bicuspid teeth which are being deflected to the lingual.

Fig. 12.—Unerupted upper cuspid to which an attachment has been secured to effect its eruption.

Fig. 13 *A*.

Fig. 13 *B*

Fig. 13 *A* and *B*.—Two supernumerary central incisors are shown in *A* with the normal central lying above them. *B* shows the same case after the extraction of the supernumerary teeth. An attachment has been secured to the central preparatory to moving it down into place. The patient is fourteen years of age.

course may be guided towards its normal position, or moved there before the inclined planes of the opposing teeth become a factor in establishing it entirely out of its normal position. (See Fig. 11.)

5. *As a guide where it is necessary to make attachments to unerupted teeth, to aid in their eruption.*

While it is not often necessary to secure attachments to teeth lying beneath the gingival tissues, the occasion for this sometimes arises, as shown in Figs. 12 and 13. In such cases, radiographs should be made as a guide in securing the

Fig. 14.—Unerupted lower second bicuspid in a patient twelve years of age.

attachment. After the attachment is secured, others should be made to determine the direction in which force should be applied to accomplish the desired tooth movement.

6. *To determine the most opportune time for the extraction of the deciduous teeth.*

Fig. 15.—Unerupted upper second bicuspid retarded in its eruption by the presence of the deciduous second molar.

Where the deciduous tooth persists in the mouth, and shows no sign of being shed, it is an advantage to determine the extent of absorption of the roots, as well as the development of its successor, so that if extraction is resorted to, it can be done with the knowledge that the developing tooth will not be disturbed or injured, and that the successor has reached a degree of development which will insure its eruption within a reasonable time. (See Figs. 14 to 15.)

7. *To observe the movement of the roots of teeth and their relationship to other roots and structures*

Fig. 16 *A*.

Fig. 16 *B*.

Fig. 16 *C*

Fig. 16 *D*.

Fig. 16 *A*, *B*, *C*, and *D*.—Unerupted cuspid teeth whose relationship to the roots of the incisors must be taken into consideration during tooth movement.

In the bodily movement of teeth, and particularly of the incisors, it is important in young subjects that these roots do not encroach upon each other or upon other teeth; for instance, an unerupted cuspid. It is, therefore, advisable, where any doubt exists, to determine the exact status of this relationship. (See Fig. 16, A, B, C, and D.)

8. *To determine the relationship of developing third molars to certain recurrent malocclusions, and also as a precaution so that steps may be taken to prevent these teeth from becoming a cause of malocclusion during their eruption.*

The pressure exerted by developing lower third molars is often sufficiently

Fig. 17.—An unerupted lower third molar which is crowding the lower incisors.

Fig. 18.—An erupting lower third molar which has been responsible for the crowding of the lower incisors and cuspids.

great to cause a crowding of the lower incisors and cuspids. (See Figs. 17 and 18). This can be true, even though malocclusion has not existed in this region previous to the development of the third molars. By making radiographs from time to time, of those patients who are of an age for development and erupting these teeth, the status of the developing teeth can be determined and the necessary precautions taken to prevent the crowding of the incisors and cuspids.

Fig. 19.—A nonvital tooth which is being used as an anchor tooth. The radiograph shows the root canals to be thoroughly filled.

Fig. 20.—Supernumerary upper second bicuspid. Upon the extraction of the supernumerary, the normal tooth erupted.

Fig. 21. Lower deciduous central incisors having the appearance of supernumerary teeth. The radiograph leaves no doubt as to their identity, and also shows that these teeth have no permanent successors.

9. *To observe nonvital teeth prior to tooth movement, to determine their fitness for movement or anchorage, and their state of health during the process of orthodontic treatment.*

Where it is necessary to either move non-vital teeth, or utilize them as anchorage, it is essential to the patient's welfare and comfort to know that such teeth and their investing tissues are in a healthy condition. By determining this prior to instituting orthodontic treatment, much trouble both to the patient and operator can often be avoided. (See Fig. 19.)

10. *In cases where anomalous teeth are present, to differentiate between anomalous and normal teeth.*

In a majority of instances, this can be done without the aid of the radiograph, unless the teeth in question have failed to erupt. Under such conditions, by utilizing accuracy in the technic of making the radiographs, little difficulty is encountered in determining the difference between normal and anomalous teeth. (Examples are shown in Fig. 13 A, and in Figs. 20, and 21.)

The International Journal of Orthodontia

PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 801-807 Metropolitan Bldg., St. Louis, Mo.

Foreign Depots—*Great Britain*—Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

Subscription Rates—Single Copies, 30 cents. To anywhere in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $3.00 per year in advance. Under foreign postage, $3.40. English price: 15/ per annum, 1/6 per number. Volume begins with January and ends with December of each year.

Remittances—Remittances for subscriptions should be made by check, draft, postoffice or express money order, or registered letter, payable to the publishers, The C. V. Mosby Company.

Contributions—The editor will be pleased to consider the publication of original communications of merit on orthodontic and allied subjects, which must be contributed solely to this journal.

Opinions—Neither the editor nor the publisher hold themselves responsible for the opinions of contributors, nor are they responsible for other than editorial statements.

Reprints—Since it is not desirable to hold type standing longer than absolutely necessary, all requests for reprints should be made at time of submitting manuscript for publication. Rate card will be sent with galley proof.

Communications—Contributed articles, illustrations, letters, books for review, and all other matter pertaining to the editorial department should be addressed to the Editor, Doctor Martin Dewey, 25 East Washington Street, Chicago, Ill. All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 801-807 Metropolitan Building, St. Louis, Mo.

Illustrations—Such halftones and zinc etchings as in the judgment of the editor are necessary to illustrate articles will be furnished when photographs or drawings are supplied by the authors of said articles.

Advertisements—Objectionable advertisements will not be accepted for publication in this journal. Forms close first of month preceding date of issue. Advertising rates and sizes on application.

Change of Address—The publishers should be advised of change of subscriber's address about fifteen days before date of issue, with both new and old addresses given.

Nonreceipt of Copies—Complaints for nonreceipt of copies or requests for extra numbers must be received on or before the fifteenth of the month of publication; otherwise the supply is apt to be exhausted.

Entered at the Post Office at St. Louis, Mo., as Second-Class Matter

EDITORIALS

Our Friend, the Toothbrush

WE have often heard the statement: "Save us from our friends, we can look out for our enemies." If the toothbrush were able to state its own case today, I am sure it would make a similar statement. Reading the articles which have been published in the various dental journals for some time past we find that the toothbrush has received a large amount of criticism from a great many critics. It has been accused of being everything from the saviour of the teeth, to the enemy of the gum tissue; but, let it be as it may, the toothbrush seems to be going on and holding its own.

Several years ago when the oral prophylaxis propaganda was gaining headway, toothbrush drills at school and in private homes were advocated as the proper method of teaching children oral hygiene. As a result of the establishment of these toothbrush drills and the education children receive in public schools as to

the necessity of brushing the teeth, we find a great many humorous incidents arising, for instance, the story of the little Italian girl who went to school one morning without having her teeth brushed and the teacher inquired as to the reason for such condition. She informed the teacher that she could not use the toothbrush that morning because her mother was using it to clean carrots.

Upon this one recommendation alone we must admit that the toothbrush has a very important place in human economy, because any instrument or tool which has more than one use certainly is a valuable addition to civilization. If oral prophylaxis specialists are willing to let the toothbrush alone, there is no doubt but that it would serve a very useful purpose and it is a question in our minds as to whether anybody could do a great amount of harm with a toothbrush because the important thing seems to be to use it regardless of how you use it.

In referring to the matter of using a toothbrush regardless of how you use it recalls the condition which arose between two gentlemen who were occupying the same stateroom on a ship. Both of them believed in oral prophylaxis, both of them believed in brushing their teeth and it seems that there was but one toothbrush between the two. The owner of the toothbrush was not very fond of having the other individual use it. In other words, he was not a believer in the community toothbrush. As a result of this the non-owner of the toothbrush arose early one morning supposing he would use the toothbrush before the other gentleman was awake, but in the midst of the oral prophylaxis performance the owner of the toothbrush awoke and saw what was occurring. As soon as the gentleman was through with the toothbrush, the owner, without saying anything, proceeded to get up out of bed, using the toothbrush for the purpose of cleaning his toenails. The psychologic effect of the act in using the toothbrush as a manicuring brush upon the toenails had a very decided effect on the individual who first used the brush, and he decided that oral prophylaxis was not what it was supposed to be. Therefore, in our minds, if the toothbrush is used as it is intended to be used, and if the teeth are brushed with it whether they are brushed up and down, bucco-lingually, mesio-distally, occluso-gingivally, crosswise or rotary, backward and forward or sideways, in using a sufficient amount of water to irrigate the oral cavity, a certain amount of good is going to be accomplished.

The trouble seems to be with a great many friends of the toothbrush, a great many of the advocates of oral prophylaxis are not content to let a brush be a brush but are trying to make something else out of it. As a result of this, we have concave and convex brushes; we have brushes with bristles which are bleached and unbleached; we have men who advocate soft bristles and those who advocate hard bristles; we have those who advocate four rows of bristles and those who advocate one row of bristles; we have those who advocate right handed brushes and left handed brushes, circular brushes, square brushes, and fountain brushes. Every conceivable kind of a brush that is believed possible to be designed has been designed. If we knew of any possible way of manufacturing a toothbrush, any possible shape that it has not been manufactured in, any possible style of bristle that has not been used, we would immediately design that brush and following the plans of some men would advocate that it is the only brush that should be used and it will be the salvation of the oral cavity, the teeth, and humanity as a whole!

With due respect to the opinion of the men who claim the toothbrush is a

detriment to the gum tissue, who claim that the toothbrush will never prevent decay of the teeth or inflammation of the tissues around the teeth, who claim that a toothbrush should never be used; in our observation no part of the oral prophylaxis propaganda is ever going to do as much good as the simple, plain old toothbrush. Also in observing the "game of oral prophylaxis from the side lines" we do not see any one of the players including the toothbrush, the toothpick, the mouth wash, the tooth powder, the tooth paste, or any of the large number of implements entering into the oral prophylaxis game that is carrying the ball any further or hitting the line any harder than the toothbrush. Therefore, in our opinion, the thing to do is to let a toothbrush remain a toothbrush, not try to make a safety razor or a fountain syringe out of it; and if the use of the toothbrush can be instilled into children, we believe that it does not make so much difference how they use it, if they only will use it. Therefore, until something better is devised, we are willing to give the toothbrush its credit whether it is antiseptic or unantiseptic, whether it contains microorganisms or no microorganisms, we still believe it is capable of accomplishing great good in the economy of the human race.

The Politician in Scientific Societies

PROGRESS in science is accelerated by the organization and work of scientific bodies, but in this as in everything else in the universe, there are two sides to the shield. Organization of scientific societies has brought into such sciences the politician, and much of the usefulness of such societies is counteracted by the baneful influence exerted upon them by this individual.

Usually scientific men care little for politics. They are engrossed with their work. They are busy seeking out new discoveries in their respective fields and in keeping the wolf from the door. Their ideals are high, and their motives clean. They attend the meetings of their society when it is possible for them to do so, keep up their dues, and read the official organ of their society—if they are fortunate enough to have one.

Such conditions make fruitful ground for the politician. He is usually a man of mediocre scientific attainments. He may have degrees conferred upon him by admiring, but second grade, universities; but so far as adding to the sum total of human knowledge by any original investigation, or special work, or in advancing science in any manner—this he never does. Usually such an individual is a good entertainer, and to the unsophisticated, is a royal good fellow. In medical and dental societies such an individual usually practices a specialty. The reason for doing this is obvious. When papers are read, he discusses them, such discussions usually being uninteresting and shallow; but discussions are popular and bring one into the limelight, and our hero, of course, must linger where the light beats around the throne.

Where this would-be satellite shines is in the election of officers and standing committees. He always has a slate ready, and by schemes, known only to men of this type, he succeeds for a time in electing to office those whom he can influence and control. Power thus achieved he trades upon for personal gain.

Medical societies, which could have become a power in advancing scientific

medicine, have been rendered inert through the baneful influence of the professional medical politician. The sadness that creeps into this problem is the fact that the condition is brought about by a slow insidious process; and before the society is aroused to its true condition, its usefulness as a scientific body is well nigh, if not entirely, gone. In this, as in tuberculosis, the victim is fatally stricken before a diagnosis is made.

The scientific society is no place for politics, especially in the sciences of medicine and dentistry. Human life and happiness are at stake. The members of these two societies are dealing with the greatest of all problems—the health of their clientele. The honest devotees in these two professions are deeply in earnest. Their goal is perfection in technic in diagnosis and treatment, and in the attainment of a broader understanding of the work before them. Petty politics do not interest them, and should not be allowed to interfere with the efficiency of their scientific societies.

Mendel's law gives us the great and the small, the morally strong and the criminal. The working of this law provides material from which those who must rule can be selected, and it leaves the great majority who are to be ruled; but the divine right of kings has been relegated to oblivion by the more just and righteous principles of democracy. The ruler must be the servant and unless you can serve you can not rule. The professional politician in scientific societies has no conception of service except that which benefits him most. Altruism is an unknown term to him. He cares for nothing except that which brings riches to his coffers or laurels to his beetle brow. To him truth in science is a strange, unknown term. Fortunately the reigns of these individuals do not last long, but they are tiresome and discouraging while they do last.

It is hoped that dental societies will purge themselves of such influences, if any exist in their midst, and will see to it that those who are honored with offices of trust, are those who are entitled to enjoy such honors by first having served.

Students and the Draft

THERE are 18,000 medical students in this country, all of whom are liable to the draft for military service—not as medical officers or hospital assistants, but as private soldiers. There is no provision under the present draft law for exempting these men or for placing them in a special department of the army. Unless a rule is laid down to cover the case, these medical students and all physicians who are drafted will not go into medical service in the army but will be put into the trenches.

There are 10,000 dentistry and 6,000 pharmacy students in the schools of the United States in addition to the large body of undergraduate students in the colleges and universities who are taking preparatory work for medicine, dentistry and pharmacy. Under the present draft law these men will be sent into the trenches to serve as private soldiers along with the regular troops. If these men are sent to the trenches their years of technical training will be wasted. Commissioner Claxton has been urging all men who are enrolled in technical courses to continue their work to completion. Even Secretary Baker says that

educated men are sorely needed by this country. And yet the administration has failed to make any attempt to exempt the young students who are to be the educated men of tomorrow.

Dr. Franklin H. Martin of the Council of National Defense has expressed himself in favor of a petition that is now being circulated among New York physicians which asks that physicians between the ages of 21 and 45 be drafted to fill up the ranks in the army medical corps, but specifically states that such a draft should exempt graduate physicians, students of medicine, pre-medical students as long as these retain their medical status, and those physicians whose services at home are essential to the public welfare in health departments, hospitals, medical colleges and isolated communities.

The medical profession would welcome such a draft law as this because it would be just and fair to the people and to the body of physicians. The failure of the present law to foresee the necessity of exempting these certain classes of technical men, and of drafting the really available men into positions which they are competent to fill rather than into the ranks of private soldiers, indicates the carelessness with which the exemption board did its work. England allowed her chemists, physicians and dentists to go with the first troops and today England is crying for skilled technical men of all kinds. England's experience was well known in this country, but the authorities here seem to be disregarding it.

The Medical and Dental Student and Conscription

LET us hope that America does not make the same fatal mistake of which Great Britain was guilty in the early days of the war by allowing her trained scientists to go to the trenches and to a needless sacrifice.

Undoubtedly our Surgeon General intends to make some provision for medical and dental students to continue their studies in order that the medical department of our army and our civilian population be amply provided for at all times with an adequate number of well trained and efficient physicians and dentists.

It does not take much effort to show conclusively that a real need for physicians and dentists will manifest itself very soon if such a provision is not made; neither does it take much effort to convince one of the logic of such a provision. An army is only efficient and an effective fighting machine, in proportion to the condition of the health of the individuals. Plenty of well trained physicians, surgeons, and dentists in the American Army will be one of the prime factors in its efficiency. Where is the logic and the common sense in taking a second, third, or fourth year medical student, a junior or senior dental student, away from college and putting him in the trenches, when a little more time given to him will make him ten times more valuable to his country? Surely the wisdom credited to the Washington authorities can see this and surely some action will be taken in time to prevent the evil that undoubtedly will follow failure to exempt or furlough such men.

At this time a representation in the Cabinet for the protection of the health of America would be invaluable. Such a portfolio with a well trained physician at its head would be quick to recognize existing needs and could secure the

needed legislation. In the absence of such a department, it is necessary for every individual to do his bit in calling to the attention of his Congressman, his Senator, the Surgeon General, and Secretary of War, Baker, the danger ahead if such a provision is not made. To the members of the medical and the dental professions, more than anyone else, is this need apparent; and they must be the ones to sound the alarm. The *Journal of the American Medical Association* had a timely editorial in the August 11th issue. Dr. Franklin Martin, Chairman of the Council of National Defense, recognizes the danger, and can be depended upon to do all in his power to stay the making of this mistake, but Dr. Martin must be assisted and given the support of every physician and dentist.

The American Society of Orthodontists, one of the oldest and most powerful dental societies in America, will meet early in September. Let them at this time take united action with reference to this and do their utmost to stay the coming of this evil. In October the National Dental Association meets. This society is to the dental profession what the American Medical Association is to the medical profession. Let this society at its October meeting take action and convey to the Surgeon General and to Secretary Baker, its feelings with reference to the matter.

This is the time of the melting pot. It makes no difference how you may have felt previous to the entry of America into the war, you must now bury all feelings and let your desire to serve transcend all else. Every physician and dentist knows that this falling off in the supply of the guardians of the soldiers' and civilians' health is a danger, and they should try to help avert it. Start writing and talking about it—and start now.

On the Treatment of Children's Teeth

At a recent meeting of the Odontological Society of New South Wales, reported in the *Commonwealth Dental Review,* the following question was asked, followed by the discussion which is herewith noted.

"*Question:* A child, under 5 years of age, suffering from ulcerative stomatitis, the cheeks and tongue being badly affected, and practically all the teeth decayed and broken out of recognition. Should the teeth be extracted?

"From many interesting replies we select the following:—

"Dr. Basil Jones: I have seen a great deal of this trouble (mostly at the Children's Hospital), and my practice has been to remove the teeth that are affected and showing signs of pus, then cleanse the gums and mucous membrane with one part peroxide of hydrogen to three of water, and finish up by painting the whole of the mouth with tincture of iodine. With this application and the use of a mild potassium chlorate mouth wash the trouble will clear up very quickly. I think it is criminal to remove the whole of the teeth, the second dentition thereby being affected.

"Dr. P. A. Burton: I think it is a great mistake to extract any of the first teeth of a child, even if the pulp is putrescent. In a few cases extraction may be unavoidable, but where pus is present I open them up when possible, or otherwise let the pus out as best I can. These teeth eventually become pretty healthy, and any trouble will be only very temporary.

"Dr. Grosse: It is better to risk the second dentition than the patient's health. I never take out any good teeth, but I think it is a mistake to leave a child with a bed of germ-producing teeth, and have them go on discharging pus simply for the sake of the second dentition.

"Dr. N. Short: I am glad Dr. Grosse has spoken in that way. I was rather startled by the remarks of the two previous gentlemen, because I did not think it tends to make the medical profession think well of us, or that we are thinking in a scientific way, to keep the roots with pus flowing into the mouth. If we can keep the last temporary molar in position, I think we are doing well. Of course, it depends largely upon the patient, but in the case mentioned in the question it is certainly one of a very anæmic child; that child needs to have as much good nourishment as possible taken into its body, free from any possibility of a neutralizing effect from carious and diseased roots and pus sinuses. Where there is pus and pain it is better to sacrifice the teeth and produce a healthy child, with chances of the second dentition being placed in the proper alignment. Develop the child first of all. I think it ought to go forth from our profession that we believe in eradicating pus.

"Dr. Oscar Paul: I agree with most of the previous speakers to some extent, but I do not think any rule can be followed to suit all cases. Of course, it depends just how far the permanent teeth have developed. If they are up sufficiently in the alveolar process to maintain and hold the space that they are eventually to erupt into, then the temporary teeth can be taken out, for the simple reason that the permanents are below. It depends also upon the conditions of the child, as the previous speakers have stated. If the child's health is suffering materially owing to their presence, it is better to extract the teeth and be prepared for the malocclusion which undoubtedly in many cases will follow later. I have seen mouths in which it would be better to sacrifice the temporary teeth; they were in a bad condition, with pus flowing from the area around the teeth. A condition of the teeth with abscesses on the roots will not only prevent the development of the maxilla itself, but also the eruption of the permanent teeth. In these cases it is certainly better to extract. At the same time I think there are too many temporary teeth extracted. Many could be saved to do a considerable amount of work; some dentists extract teeth that the child could get good service from, and which are not causing any ill results by their presence, but are aiding in the development of the maxillæ.

"Dr. Deck: Many cases of marked malpositions of the permanent teeth are directly due to the nonabsorption or only partial absorption of the roots of nonvital deciduous teeth; and so, while I believe in attempting to treat and retain as many teeth as possible in such a case as this, great care must be exercised that they are not allowed to remain so long in place as to produce some malpositions of their successors. Another thing that I am sure most of you will have noticed, as being a result of leaving these septic deciduous roots in place, is that the crown of the permanent tooth is markedly eroded and pitted from the action of the pus, and is more liable to be attacked by caries, so that I think this is another reason why one should remove chronically abscessed deciduous teeth."

Seventeenth Annual Meeting of the American Society of Orthodontists

ELSEWHERE we print the complete program of the Seventeenth Annual Meeting of the American Society of Orthodontists, to be held in Excelsior Springs, Mo., September 5, 6, 7, and 8, 1917. The program for this meeting is an attractive one. Papers will be read on collateral subjects by men, prominent in their work, that will be of interest to orthodontists.

It is an encouraging sign to see specialists interested in matters not directly concerned with their work, but which indirectly has an important bearing on it. This signifies that specialism is broadening and argues well for its future.

Excelsior Springs is a delightful place for this meeting. It is within two hours' ride from Kansas City, one of our great railroad centers. The Elms, one of the best resort hotels in America, will furnish accommodation that will satisfy the most exacting. One of the attractions of this hostelry is a well maintained golf course.

Make your plans now to attend this meeting.

The program committee have worked hard to secure men of great ability with an international reputation to read papers and give clinics, and they have succeeded. Show your appreciation of their work and your interest in orthodontia by attending this meeting. Bring your golf clubs with you.

Wednesday, Sept. 5.

9:00 Meeting of the Board of Censors.

10:00 President's Address.
M. N. Federspiel, Milwaukee.
Discussion opened by:
A. H. Suggett, San Francisco.
C. A. Hawley, Washington.

11:00 Report of the Board of Censors.
Election of New Members.
Reports of Committees.

2:00 A Case from Practice: A Complete Presentation of the Details of its Treatment.
Calvin S. Case, Chicago.
Discussion opened by:
F. C. Kemple, New York.
S. M. Weeks, Philadelphia.

3:00 A Further Study of Prenatal Causes of Dentofacial Deformities.
B. W. Weinberger, New York.
Discussion opened by:
Martin Dewey, Chicago.
W. J. Brady, Kansas City.

4:00 The Teeth in Sorcery and Magic.
C. C. Allen, Kansas City.
Discussion opened by:
R. Ottolengui, New York.
M. T. Watson, Detroit.

Thursday, Sept. 6.

9:00 Further Experience with the .020 Arch-wire.
Ray D. Robinson, Los Angeles.
Discussion opened by:
D. W. Flint, Pittsburgh.
A. H. Suggett, San Francisco.

10:00 The Surgical Treatment of Extreme Malformations Involving the Jaws, Tongue, etc.
Gordon New, Rochester, Minn.
Discussion opened by:
M. H. Cryer, Philadelphia.
M. N. Federspiel, Milwaukee.

11:00 The Oral Efficiency of Therapeutic Preparations.
H. Prinz, Philadelphia.
Discussion opened by:
F. S. McKay, Colorado Springs.
L. W. Baker, Boston.

2:00 Orthophotography and Multiview Projections.
R. Hanau, Pittsburgh.
Discussion opened by:
W. A. McCarter, Topeka.
R. Waldron, Newark.

3:00 Constitutional Diseases in Infancy and Dentition.
G. Lippmann, St. Louis.

Discussion opened by:
H. Prinz, Philadelphia.
A. McCann, New York.

4:00 The Proper Feeding of Growing Children During the Transitional Period from the Deciduous to the Permanent Denture.
Alfred McCann, New York.

Discussion opened by:
E. A. Bogue, New York.
G. Lippmann, St. Louis.

Friday, Sept. 7.

9:00 The Indirect Method of Anchor-band Construction.
Martin Dewey, Chicago.

Discussion opened by:
W. A. Coston, Topeka.
C. A. Hawley, Washington.

10:00 The Concealed Labial Arch-wire with Spring Extensions.
L. S. Lourie, Chicago.

Discussion opened by:
Martin Dewey, Chicago.
W. H. Ellis, Buffalo.

11:00 Practical Radiography for the Orthodontist.
E. H. Skinner, Kansas City.

Discussion opened by:
S. P. Cameron, Philadelphia.
J. D. McCoy, Los Angeles.

2:00 A Summary of the Results of Metallurgical and Physical Researches and Their Practical Application in Orthodontia.
Louis J. Weinstein, New York.

Discussion opened by:
C. J. Grieves, Baltimore.
C. S. Case, Chicago.

4:00 The Teaching of Orthodontics from the Standpoint of the Student.
W. C. Fisher, New York.

Discussion opened by:
M. Dewey, Chicago.
H. Pullen, Buffalo.

5:00 Unfinished Business.

Saturday, Sept. 8.

9:00 *Clinics.*
L. J. Weinstein
Practical Demonstration of Metals and Alloys as Applied to Orthodontia.
First Clinic, 9:00-10:00.
Second Clinic, 10:15-11:15.
Third Clinic, 11:30-12:30.

W. A. McCarter
A Practical Method of Orthodontic Photography.

Grafton Munroe
Pullen's Fracture Band for Use in War Surgery.
Also Case Clinic.

C. S. Case, Carl B. Case
New Midget Appliances for Deciduous Dentures.
Construction of a Six-band Retainer.
Demonstration of the Contouring Apparatus.

F. C. Rogers
Chart for Trimming Plaster Models.

Alden Carpenter
Appliances for Army Fractures.

B. F. Gray
Case Report of Retarded Development.

H. Keeler
Rotation and Retention of Central and Lateral Incisors.

R. C. Willett
Subject to be announced.

R. Waldron
Subject to be announced.

C. R. Baker
Table Clinic.

B. E. Lischer
Life-size Photographs of Dentofacial Deformities.

W. A. Coston
Band Construction Over Amalgam Models.

O. A. Oliver
Impressions and Casts.

V. H. Jackson
Case Records.

11:30 Final Session.
Installation of Officers.
Adjournment.

The Chaos of Oral Prophylaxis

THERE is no one who will deny the value of oral prophylaxis as an adjunct to the health of the individual or the preservation and care of the oral cavity. The oral prophylaxis propaganda, which started several years ago, has reached a considerable proportion and the importance of it is being recognized by the medical and dental professions and by the laity. However, notwithstanding the number of years the doctrine of oral prophylaxis has been preached, to one sitting up in the gallery and observing the proceedings, it is a state of affairs that seems to be more or less chaotic at the present time. During the past few months we have been privileged to listen to papers by a number of specialists along oral prophylaxis lines. Strange as it may seem, these specialists have been agreed only on one thing, and that is the value of oral prophylaxis in preserving the health of the teeth and the oral cavity, the value of oral prophylaxis in the health of the individual, and almost universally summing up their statement by saying "that a clean tooth never decays." These are about the only factors that oral prophylaxis specialists seem to be agreed upon.

We find a number of them advocating the use of the toothbrush and equally as large a number enthusiastically decrying its use. We find those who want a toothbrush which presents a large number of rows of bristles, sufficiently large to brush the upper and lower teeth at the same time, and we find those who claim that the toothbrush should have only one row of bristles, and taking the matter further, we find that the poor old toothbrush is even discarded entirely by some specialists.

Taking the question of tooth paste, we find them equally divided; some claiming that tooth pastes should possess grit for polishing the teeth; others claiming that they should possess none; some claiming that one should use only a small quantity of tooth powder on the brush while others claim a large amount should be used, a sufficiently large amount of tooth powder so the bacilli will become confused, become mixed up in the tooth powder and be washed off with a stream of water. We find them divided the same in regard to tooth paste, some claiming that tooth paste produces deleterious results by clinging around the gingiva, making a deposit or debris in which the bacteria grow, others claim that the tooth paste mixes the bacteria, rolls them over and over and causes them to be washed out of the oral cavity.

Likewise in the question of mouth washes: Some advocate antiseptic mouth washes containing all sorts of ingredients or medicines and strongly astringent and antiseptic to mild antiseptics such as boracic acid, soda, and salt solution. There are even enthusiasts who claim that the best mouth wash is nothing but pure water. Each one of these men is equally positive that the results he is accomplishing are better than the results the other man is accomplishing.

If one bases his observation only upon listening to these gentlemen talk, or ladies, as the case may be, the matter becomes very confusing and it is almost impossible to draw a line of deduction of the statement which the oral prophylaxis specialist makes. We find those who advocate the active use of the tape containing a gritty powder for polishing between the teeth. We find those

who are equally enthusiastic in decrying the use of the tape or silk floss as being factors which make grooves in the proximal surfaces of the teeth, injure the gum tissue, and assure the loss of the teeth provided a tape charged with a powder is used. Others are enthusiasts in using a polishing strip for polishing the proximal surfaces of the teeth, while still others are just as positive in decrying the evil effects derived from it.

If we follow the oral prophylaxis specialist further in his argument, we are forced to conclude that a great many of them pass the point where they cease to be oral prophylaxis specialists and become treaters of pathologic conditions. The treatment of pathologic conditions in the oral cavity is almost as chaotic as the treatment of the mouth along prophylactic lines. It is our opinion that there should be some differentiation made between oral prophylactic treatment and the treatment of pathologic conditions. We have always believed that a prophylactic measure was one which prevented, while the treatment of pathologic conditions is one that has for its object the curing of a disease and the reestablishing of healthy conditions in the parts. After a pathologic condition has been treated and the parts have become healthy or the disease has been eradicated, then prophylactic measures or prophylactic treatment again becomes the proper thing. The further we go in the study of pathologic conditions the more muddled up and troubled the water becomes to one who is simply trying to base his diagnosis or his prognosis upon conditions as he hears them explained by specialists along these lines.

If we were compelled to make our conclusions from the statements which we have heard from men engaged in the practice of oral prophylaxis, about the only positive thing that we could say is that the oral cavity should be cleaned. In the various statements which have been made it does not make so much difference what is used to clean it—whether absorbent cotton or toothbrush or toothpicks, orange wood sticks or rubber cups, pumice stone or castile soap—the important proposition is that it be kept cleaned. Another factor which a great many men overlook is the fact that the treatment which will be indicated for one individual will not be so successful for another. This is proved by the fact that a great many individuals pay little attention to the care of the oral cavity, yet the teeth and mouth are reasonably clean. This is because they are living in an environment, leading a life, using food, giving a certain amount of usage to their teeth, performing the functions of mastication, which functions or acts accomplish in a natural manner the things which have been intended by nature. It must also be remembered that in one mouth a gritty tooth powder would be desirable especially if the deposits upon the teeth were very gelatinous and gummy.

It must also be remembered that the use of gritty tooth powder for the cleaning of teeth as a prophylactic measure may become an objectionable thing in the mouth of the individual who possesses pathologic conditions, pockets around the teeth where the gritty substance in the tooth powder or tooth paste may collect and therefore become a foreign irritant. With a normally shaped tooth and a normal gingival marginal ridge and a normal development of the gum tissue around the teeth, there is very little possibility for the gritty substance of a tooth powder or a tooth paste to get down around the gingival

margin of the tooth and cause any trouble. It must also be remembered that in certain mouths an alkaline mouth wash will be desirable while in others an absolutely neutral mouth wash would be indicated, and in some even an acid mouth wash would be a desirable thing. In other words, the state of health or the condition of the oral cavity should be made an indication for the kind of mouth wash to be used and the same plan of treatment should not be used on all patients nor the same plan of oral prophylactic treatment employed in all individuals. If every individual lived exactly the same kind of a life, had the same kind of diet, followed the same habits, there is no question but what the same treatment would be advantageous in each case. Therefore it seems to us that the great trouble with oral prophylaxis at the present time is the majority of practitioners are trying to make one treatment suit all individuals. They are trying to make everybody live according to the same plan so far as the care of their mouth is concerned and this is not rational until everybody lives according to the same plan as regards habits, diet, and other environments. In order to overcome the chaotic condition which is present in the treatment of oral prophylaxis today the problem must be approached not from the angle of treatment but from the angle of diagnosis or a clearer and more scientific understanding of the needs of the oral cavity before a line of treatment is indicated. There should be more careful study of the analysis of the saliva, the food habits of the individual, the natural tendency of the diet to keep the teeth clean or to do otherwise; then a proper line of treatment could be established for each individual which would do him more good and be of much greater benefit than a fixed treatment applied to every individual whether indicated or not.

A Word to the Radiographer

LET us reason together and see if we can not be mutually helpful one to the other, and serve the people better than we are doing. We—the men who do not make x-ray pictures—need your aid in many ways, and we cheerfully accord to you the ability to produce a better picture than we could possibly do. But we want you to remember this one thing and abide by it: you have absolutely no right to diagnose any case and pass your opinion upon it without consultation with the dentist who has had the case in charge. No x-ray evidence should ever be taken except in conjunction with the clinical history of the case. Not that we ask you to merely take a picture and remain passive in the matter. We welcome your opinion stated to us frankly, whether that opinion is right or wrong. You may be able to detect evidence in a picture that we would overlook, and we thank you for calling our attention to it. But we ask you to cease from this time making a diagnosis to the patient, and writing those mystic and formidable legends on x-ray pictures, "pus-pockets," "infection," etc., etc., and handing it to the patient.—*Commonwealth Dental Review.*

The International Journal of Orthodontia

Editor: Martin Dewey, D.D.S., M.D.

VOL. III — ST. LOUIS, SEPTEMBER, 1917 — NO. 9

ORIGINAL ARTICLES

SOME REASONS WHY THE GENERAL PRACTITIONER SHOULD NOT DO ORTHODONTIA

BY E. G. WEEKS, D.D.S., SAGINAW, MICH.

IN CONSIDERING the subject of the general practitioner in relation to orthodontia I realize that I may be accused of personal motives and may be accused of trying to further my own interests as a practitioner of orthodontia. However, there are so many reasons why the general practitioner should not attempt the correction of malocclusions that I am going to attempt to show you some of these today and thereby substantiate the fact that orthodontia belongs to men who are educated along certain lines. I am willing to admit that in some instances general practitioners of dentistry may be able to correct simple cases of malocclusion, which may involve the correction of one or more teeth in the anterior region; but when the attempts to correct malocclusions involving the posterior teeth are considered, I believe the general practitioner is entirely out of his field. My reasons for coming to this conclusion are many. In the first place, the average general practitioner knows nothing about the normal occlusion of the teeth from the standpoint of forces of occlusion as being the factors in the production of normal occlusion. The average practitioner of dentistry knows little in regard to muscular stress relative to the eruption of the teeth, the effect of atmospheric pressure in the development of the mandible and the maxilla, the importance played by the inclined plane and the proximal contact points, and the intimate relation of harmony in the size of the arches as regards the correction of normal occlusion. If a general practitioner is ignorant of these things, which are fundamental basic principles in the correction of malocclusion, how can one expect him to obtain results in the correction of malocclusion that will reach any degree of efficiency.

I want to also condemn a practice which is being followed by a number of men in general dentistry, and which seems to a certain extent to fulfill a certain

need or desire among a number of men, and that is the correction or treating of malocclusions by a correspondence system. In fact the practice of dentistry is carried on entirely too much by the correspondence route. We have dental laboratories who attempt to make plates, crowns, inlays, and bridges for some man in Michigan, Illinois, or Missouri, and these restorations are made by men who have never seen the patient and are made in some distant laboratory in New York, Chicago, or some other foreign point. A similar system is springing up in the practice of orthodontia as there are a large number of orthodontic laboratories who make appliances over models for the general practitioner. Some of these orthodontic laboratories, that are interesting the men in practical appliances, are more or less honorable, and in some instances refuse to fit appliances to models, if in their minds the general practitioner of dentistry does not know enough about orthodontia to properly use the appliance after it is fitted to the model.

There are other laboratories or orthodontic manufacturers of appliances who will fit the appliance to any kind of a model for so much an appliance, expecting the dentist to obtain results or no results, whichever the case may be. The manufacturer of the appliance has received his price for the appliance, and feels perfectly free of the obligation.

There are other laboratories which claim to have a follow-up system of correspondence whereby they give advice to the general practitioner in regard to how a case should be treated. While I realize it is possible from the study of a model to design an appliance more or less suited to the case, the next proposition is whether the dentist for whom the appliance is made can properly use the appliance after it is adjusted to the model. Can the appliance be transferred from the model to the mouth so as to do the proper amount of work which it was designed to do? This is very much of a question.

Concerning the correction of teeth by the correspondence system, we find advertised in the dental journals at the present time, or at least in one journal, a very elaborate method under the term "Orthodontic Engineering" whereby charts are made of certain cases, appliances are designed, and the maps of malocclusion and charts are sent to the general practitioner, with the information that by following these orthodontic charts, he will be able to accomplish as satisfactory results as are accomplished by men who have been engaged in the practice of orthodontia for years. Admitting competent orthodontic engineering has a certain future and place in orthodontia, I do not believe it is possible by making a few maps of malocclusions to instruct the general practitioner so thoroughly that he can treat satisfactorily malocclusions, unless he has had other training along orthodontic lines.

I believe a large number of these advertised orthodontic appliances, and orthodontic engineering concerns are misleading, and hope that in the future dental journals and orthodontic journals will be more careful in advertising such concerns than they have in times past. I do not so much question the ability of the man making or designing the appliance for the dentist, for in his own office he may be a satisfactory and efficient workman; however, I do question the ability of the man to design an appliance for teeth he has never seen, advise what development is necessary in the facial growths of patients he has never

seen, and still expect the general practitioner to get a result which will be equal to the specialist who has the patient in his office and follows the case very carefully. Even after the appliance is properly designed, the case may be a failure because the general practitioner has not sufficient orthodontic technic to properly adjust the appliance, or get the greatest efficiency out of it in the particular type of malocclusion under treatment. It is also known that general practitioners are very prone to follow the advice given by certain prominent men in the dental profession, men who have been engaged in the practice of orthodontia, and I know of a large number of patients in our community who are going through life with deformed faces because they were following the advice taught by a certain man, and have teeth extracted in cases where the teeth should not have been extracted. I can only say that "a little knowledge is a dangerous thing" and a little orthodontic knowledge is probably more dangerous than any other kind. That the average practitioner knows very little about malocclusion can be very easily proved if you will ask him in regard to the development of the mandible and maxilla, the action of the osteoclast or the osteoblast, or even

Fig. 1.

for a concise and positive statement in regard to the classification of malocclusions. If you ask him anything about the principles of appliances, certain kinds of anchorage or retentions, it would be like talking a foreign language to him. If he does not know the fundamental principles of orthodontia, how can he be expected to even get a satisfactory or serviceable result for his patient? The general practitioner may be a very clever workman in certain dental lines, but that does not necessarily insure that he is capable of correcting the different types of malocclusion. In fact, sometimes the simplest types of malocclusion cause the most serious results because what appears to be a simple type is really a complicated condition.

Anyone who has been engaged for any length of time in the practice of orthodontia invariably has come across cases of older patients that have been treated in the past by dentists; and examination of that case almost invariably will reveal misplaced molars or premolars, extracted teeth, and very often results which are worse than in the beginning. We very often see cases that have been treated by dentists, who are general practitioners, for two or three years and results have not been accomplished in that time, and it is questionable

if they ever will be accomplished. I know of three cases in which premolars have been turned so the buccal cusps were to the lingual, which might be permissible in some instances, but which in this case probably resulted because the dentist did not know which way to turn the tooth.

To further substantiate my argument that the general practitioner should not treat malocclusion, I will show some of the cases which have come under my observation, which, to a certain extent, bear out my contention. A great many general practitioners pay very little attention to the occlusion of teeth and some even neglect to consider the dental apparatus sufficiently carefully to know what are present and what are missing.

Fig. 2.

Fig. 3

Fig. 4.

Fig. 1 shows a case in which the deciduous canine was present at eighteen years of age. A swelling or infection occurred around this tooth and the case was diagnosed as an abscess of a deciduous canine. The deciduous canine was extracted and a bridge was put in its place. For a short time the patient was relieved because of the opening and the establishment of drainage, but results were not as satisfactory as they seemed. The pain was not entirely relieved and there was considerable swelling. Iodine was used as a counterirritant until the patient could stand it no longer. Finally, upon the use of the x-ray, an impacted canine was revealed as is shown in Fig. 1; and not only was this canine impacted, but all four permanent canines were still unerupted.

Fig. 2 shows the model of a patient who had worn a bridge for a number of years to replace a missing central. The radiograph showed the right central to be in a right angle position to the lateral and in the floor of the right nostril. By cutting away the process with a large surgical burr and drilling a hole in the tooth and cementing a pin in the tooth it was possible to bring the tooth into very nearly perfect position at the present writing.

If such cases as these, with such malocclusions and impactions of teeth are overlooked, would one expect such men to be capable of treating complicated cases of malocclusion? As an example of some of the orthodontic results that have been obtained by general practitioners of dentistry I present Figs. 3 and 4,—the mother of one of my patients. This woman evidently had possessed a neutroclusion case with contraction of the upper anterior teeth and protruding canine, or tusks, as she called them. Her dentist straightened the case for $5.00, with the results which can be seen; that is, he extracted the two upper canines. The underdevelopment of the premaxillary region causes a very grave facial deformity, and while the case looks like a mesial occlusion case, the molars are actually in normal mesial relation.

Fig. 5.

Fig. 5 shows the models of the daughter of the woman shown in Figs. 3 and 4. This is also a case of neutroclusion with lingual version of the upper molars and premolars and protruding canines. Owing to the fact that the mother had had such a satisfactory orthodontic result obtained for $5.00 her education was neglected and she supposed the daughter should be treated the same way. When I explained to the mother what was necessary, the length of time involved in completing the case, and the necessary expenditure, she was very much alarmed and concluded I was a robber. She insisted she would have the canines extracted for her daughter the same as had been done for her. However, owing to the influence which I had with the dentists in our city, the case was repeatedly referred back to me. For a year the mother and I had our arguments in regard to the proper kind of treatment, but finally the proper treatment was instituted and she is now one of my best friends.

Figs. 6 and 7 show the profile of a case before treatment. Fig. 8 shows the profile at the present time. In comparing the results obtained by treatment in the mother's case and the results which are being obtained for the daughter we have a very strong argument as to why the general practitioner should not attempt to correct a complicated case of malocclusion.

The large number of unsatisfactory results obtained in the practice of general practitioners in the correction of malocclusion are very easily cited. However, I wish here to report one case in which the history is more or less complete to show you the large amount of facial deformity that can be produced by a general practitioner in a very short time.

Fig. 9 is a photograph of a baby that shows a very good facial development and a good chin; in fact, the face is practically as normal as one would find at that age. Fig. 10 shows the patient at six years of age with a normally developed face because all the teeth are present and performing their proper

Fig. 6.

Fig. 7.

Fig. 8.

function. Fig. 11 shows the patient at nine with a good face, a well-developed chin and a normal dental apparatus. When her second upper premolars erupted, they came in slightly out of alignment and were pulled, as was also the lower second bicuspid. As soon as these teeth were extracted the development of the dental apparatus and the lower part of the face began to be abnormal and Fig. 12 shows the patient at the age of fourteen. The photographer, in order to get a better facial result, has tipped the chin in such a manner as to overcome the deformity. Figs. 13 and 14 show the facial result at nineteen years of age. There is no question in my mind but that the extreme facial deformity, the underdevelopment of the mandible and receding upper lip, has been produced by the extraction of the premolars which caused an underdevelopment of the dental arches, resulting in the underdeveloped face. A study of this patient's face

from babyhood to nineteen years of age is another proof as to why the general practitioner should not attempt the correction of malocclusion.

Fig. 15 shows the models of the faces shown in Figs. 13 and 14 at nineteen years of age. From a study of these models it is very evident that the man who extracted the bicuspids had absolutely no knowledge of the fundamental basic principles of orthodontia.

Fig. 9.

Fig. 10.

Fig. 11

Fig. 12.

I have called attention to the evils which may result from the man who attempts to use mail order appliances, and cite the case shown in Fig. 16 as an example. These models were made by a dentist who simply looked at the overlapping upper anterior teeth and concluded the proper thing to do was to order an appliance from a mail order house. The appliance was placed in position

Fig. 14

Fig. 13.

and after three years of treatment the result shown in Fig. 17 was obtained. No attempt had been made to correct the distal occlusion, and in addition to that a bad overbite has been produced. Besides the patient having been suffering from the inconvenience of a long drawn out treatment, it is a grave question

Fig. 15

Fig. 16.

Fig. 17

whether the case is not in a worse condition than it was before treatment was begun.

A few of these results would soon lead one to believe that the general public would be much better if the general practitioner of dentistry did not attempt the correction of malocclusion. Not only are the treatments instigated

by general practitioners very unsatisfactory, but in a great many instances even the advice given to prospective patients is of the worst character.

Fig. 18 shows the models of a girl nineteen years old who had a bad open bite besides the complete distal occlusion of the lower arch. The mother of this patient had been advised by three different dentists to have the molars extracted even though the canines are not yet in position. It would be very easy to imagine the undesired facial result that would have been obtained had this kind of treatment been followed, besides the extreme malocclusion that would have developed.

Fig. 18.

Fig. 19-*A*.

Fig. 19-*B*.

Figs. 19, A and B, are the patient's face, and by a study of the face, one realizes that the underdeveloped mandible should be increased in size if possible, the upper arch widened so as to produce normal breathing and, in fact, a plan of orthodontic treatment pursued which would be far different from that advised by the general practitioner of dentistry. The greater number of these

cases we see the more we are impressed with the fact that the general practitioner of dentistry should receive education in the basic principles of orthodontic treatment so that he will be able to advise his patients intelligently and prevent some of the unfortunate occurrences that have taken place in the past.

Figs. 20 and 21 show the father of two of my little patients who has been the victim of improper orthodontic treatment. His teeth were irregular when a child; and when a young man, he went to his dentist, who straightened them. The result of this straightening procedure can be very easily seen by examining the face. While he was a young man, his facial development would suggest that he was somewhere in the neighborhood of fifty. The underdeveloped condition of the mouth, the receding chin, all speak of improper orthodontic treatment in the hands of general practitioners. Fortunately, this man realized he had not received the proper treatment and, therefore, avoided having his children fall into the hands of someone and receive such treatment as he did.

Fig. 20. Fig. 21.

Fig. 22 shows models from a little girl's mouth, while Fig. 23 is a child's face. It is very easy to see that if she received the same plan of treatment her father did the facial deformity would be very great. However, with the proper plan of treatment and proper forces applied upon the teeth the teeth can be made to assume a proper position, and the face, a normal development. Not only does the patient suffer from improper orthodontic treatment at the hands of the general practitioner, but some of the results obtained by general practitioners are judged to be the proper or only kind of orthodontic results that can be obtained. Very recently a surgeon came to me with the question as to whether the correction of malocclusion could not produce enlargement of the submaxillary glands. I told him I had never seen such conditions occur. I was asked to examine two children who had been in the hands of a general practitioner undergoing orthodontic treatment, and found the lower molars very badly infected, and in fact all of the alveolar process absorbed around them. The result of the absorption of the alveolar process on the four permanent molars had been produced by improper stress from regulating appliances and consequently the resulting infection and irritation had traveled to the submaxillary glands. It is also very probable that the use of wire ligatures had been allowed

to infringe upon the peridental membrane of the premolars, which had also produced infection with the result that the entire oral cavity was in very bad shape. Consequently, medical men who had not seen proper orthodontic treatment were inclined to judge all orthodontic results by the unfavorable result which they had seen produced by the general practitioner of dentistry. Consequently, in this case not only did the patient suffer, but the entire orthodontic profession suffered from the incompetent treatment of the case in the hands of the man who knew nothing about the basic principles of orthodontics. Other physicians have told me of thyroid glands becoming so badly infected that they had to remove them while the dentists were straightening irregular teeth. I

Fig. 22

Fig. 23.

also know of two young ladies, aged, respectively, eighteen and twenty-one, who had bad cases of malocclusion and the dentist put the anterior teeth in each case in somewhat acceptable shape in three months' time. Afterward radiographs proved pyorrhea or something else had absorbed the process of all the anterior teeth. In each case another dentist extracted eight teeth for the young ladies. Therefore, as a result of this, the information becomes prevalent among the public that orthodontic work is a failure, that teeth loosen and come out after being regulated and again orthodontia receives unfavorable comment because it is practiced by men who know nothing about the subject.

As the result of these unfortunate conditions which I have cited to you,

I am forced to adopt the opinion that general practitioners should do very little orthodontia, if any, and that we, as orthodontists, should exert every effort possible in educating the dental profession along this line, and causing them to realize the importance of this work so they will not attempt something they are not familiar with. It has been my experience that the general practitioner who knows the most about orthodontia is the man who attempts to treat the fewer cases. If the general practitioner realized the importance of malocclusion and the histology of the tissues supporting the teeth, the possibility of normal development, and the danger of improper stress, he would be a much more valuable man in the support of orthodontia than the man who knows nothing whatsoever. Therefore, I believe that the best thing the orthodontist can do for his own salvation is to properly educate the dental profession along orthodontic lines until they realize the importance of the work and realize that "a little knowledge is a dangerous thing" and unless the case is properly handled, a large amount of unsatisfactory results will occur, which not only has a bad effect on the general practitioner himself, but on orthodontia and dentistry as a whole.

THE IMPORTANCE OF THE APPLICATION OF THE LABIAL ALIGNMENT WIRE

By Martin Dewey, D.D.S., M.D., Chicago, Ill.

WITH the advance of various new types of regulating appliances, including the pin and tube appliance, the ribbon arch, the Robinson appliance, and various other appliances with different attachments and designs for the purpose of bodily tooth movement, a great many men have recognized the fact that the principle employed in all of these styles of regulating appliances dates back to plain alignment wires. Because of the great amount of benefits and results claimed to be obtainable by these so-called new styles of appliances, a great many men have believed that the labial alignment wire is out of date, and consequently should not be taught or considered. The question was recently asked me by a man who is foremost in the orthodontic profession, whether we still taught our students in college the use of the plain expansion arch, as he called it, or the labial alignment wire. When informed such was the case, he immediately expressed the opinion that we were out of date because we did not confine ourselves to the newer forms of appliances. I believe that it does not make any difference what style of appliance is used, but in order to work any of these newly patented appliances it is necessary to have some knowledge of the basic principles as illustrated in the old style expansion arch.

It has been stated that every tooth movement is accomplished by pulling or pushing, which is true, and often has been stated that for every action there is an equal reaction. This is true with any appliance regardless of the kind used. I do not see how it is possible for a man to successfully employ any of the new style appliances, whether it be the labial or the lingual appliance, unless he is familiar with the mechanical principles involved in the old style expansion arch, which is better termed an alignment wire. It is also because of the fact that I have seen some very deplorable results produced by the improper adjustment of alignment wire and the regulating appliances that I am calling attention to the importance and necessity of the proper appreciation of the principles employed in the alignment wire in order not to produce untold harm.

In considering the alignment wire, or expansion arch, such as is shown in Fig. 1, one must remember that the alignment wire embodies the principle of the spring lever and the screw. The alignment wire should be divided into two parts, representing the incisor and canine section, which may, in the majority of cases, be considered the spring portion of the alignment wire. The posterior portion extending back from the bend in the canine region may be considered the heel of the arch, or the threaded portion, which may have an active spring or which may be inactive. It is because of the fact that this posterior heel of the arch may be inactive or active that we are able to accomplish certain results, and it is also because of this spring in the posterior heel of the arch that we see in some instances undesirable results. It must be remembered that as the alignment wire possesses a certain amount of spring, the posterior end of the alignment wire must bear a certain definite relation to the tube on the molar band or

change will occur in the molar region. One must also realize regardless of what position the alignment wire assumes when placed in the tube, that it is naturally going to move the attachment to a point where the alignment wire will become absolutely passive. It is the failure to recognize the continual action of the spring force of the alignment wire that is responsible for a great many of the unsatisfactory and undesirable results, amounting almost to criminal neglect, that we see in some cases under treatment. It must be remembered that the screw section on the alignment wire is to be used primarily for bringing the anterior teeth forward and is not to be used as a means of increasing the expansion of the dental arch.

Fig. 1.

I have seen a number of unfavorable results produced because men have attempted to expand dental arches by lengthening the lateral halves of the alignment wire by the use of the nut. Such a procedure always results in failure, and the expansion of the dental arch is long and narrow, or there is a forcing distobuccally of the anchor teeth. The great possibility of a distobuccal movement of the anchor teeth when the alignment wire is being used was called to the attention of the profession several years ago by Dr. Barnes, of Cleveland. If, in adjusting the alignment wire, it is desired to produce an expansion of the molar region without the rotation of the molars, care must be taken to see that the alignment wire lies parallel to the tooth on the molar band when the alignment wire is in a state of rest. (Fig. 2.) A great many cases are seen in which the alignment wire has been placed in a tube on the molar band, not occupying a parallel position to the molar; the molar has necessarily been rotated into an unfavorable position. In certain cases it is desirable to rotate the molar, which can be easily accomplished by having a definite position between the tube and the alignment wire. The adjustment of the alignment wire as seen on the left side in Fig. 3 is such as will produce a buccal rotation of the mesio-buccal angle of the lower molar. This style of rotation would be more efficient if a plain band were used instead of the clasp band, as there would be nothing irritating

on the lingual side of the band. In order for the mesio-buccal angle of the molar to rotate with the clasp band, the screw must necessarily stand away from the second premolar as shown in Fig. 3, which would be more or less irritating to the tongue.

Fig. 2.

If it is desired to rotate the distal angle of a molar buccally, the same can be produced by so adjusting the alignment wire as shown in Fig. 4. Fig. 5 shows an adjustment of the alignment wire, which rotates the mesio-buccal angle of the molar lingually. These adjustments of alignment wire are by no

Fig. 3.

means new, and they have been called to the attention of the profession a great many times and are here given again simply because of the numerous cases which have been called to my attention recently where men have failed to recognize this phase of alignment wire adjustment. I have called attention to the

fact that the alignment wire embodies the spring force and have also stated that the spring force can be obtained from the posterior heels or a section of the arch, which adjustment is not very well understood by many men attempting to use the alignment wire. The adjustment of the alignment wire to shift the

Fig. 4.

median line of the arch in such a case as is shown in Fig. 6 is not well understood. In fact, the majority of men undertake to shift the median line of the arch in such cases by the use of the threaded portion of the alignment wire, which produces an undesirable movement of the anterior teeth. As the median

Fig. 5

side of the upper arch needs to be shifted to the right, the alignment wire should be adjusted as is shown in Fig. 7. It will be seen that the alignment wire hugs the teeth closely on the left side, stands away from them on the right, and carries lugs for the purpose of receiving wire ligatures. While the method of at-

taching to the anterior teeth may be one of personal selection, it makes very little difference what style of attachment is used; for in order to get the necessary movement, the alignment wire must be so adjusted as to give the spring

Fig. 6.

shown in Fig. 7 and 8. In this case the spring will shift the median line of the arch in the lateral half of the posterior heel of the alignment wire and, therefore, when the alignment wire is sprung into position as shown in Fig. 8 from Fig. 7,

Fig. 7.

a force drawing the upper anterior teeth to the right is obtained which is very effective in shifting the median line.

It must be remembered that the labial alignment wire, or, in fact, any style

of appliance that is used embodying a spring is an active force, and will continue to act until the teeth are moved into such a position that the appliance is absolutely passive. It must also be remembered that anchor teeth, if subjected to a lateral stress or a stress of torsoversion, will be changed in their position and shifted as the result of the force of the alignment wire. It is because so many

Fig. 8.

men are attempting to use complicated regulating appliances before they have mastered the mechanical principles of a simple alignment wire that I am calling attention to these facts for I am aware that a great many unsatisfactory results are produced in different parts of the country by men attempting to use appliances before they are versed in mechanical principles.

THE LABIAL ARCH WITH SPRING EXTENSION AS USED BY DR. LLOYD S. LOURIE

By Martin Dewey, D.D.S., M.D., Chicago, Ill.

In Vol. II, No. 10, of the Journal is an article describing the lingual arch in combination with the labial arch with extension as used by Dr. Lloyd S. Lourie, in which Fig. 1 is shown as Fig. 12. Fig. 1 shows the labial arch with

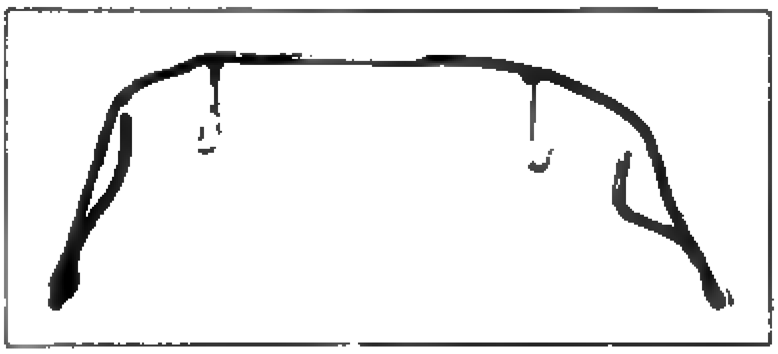


Fig. 1

the spring extension, but a description of the advantage of those spring extensions as used by Lourie is not given in that article. In order to illustrate more completely the advantage of the spring extension the following is published.

Fig. 2.

The spring extensions are designed primarily to be used in the movement of the teeth bodily, or otherwise, and are used in such a manner as to also control rotation or torsoversion. Fig. 2 shows the occlusal view of an upper arch in which it is necessary to produce considerable movement of the lateral incisors, also an apical movement and a rotation In selecting appliances it was decided that the labial arch with a spring extension would be better suited to the needs of the case and more nearly fill the physiologic and mechanical requirements of a good regulating appliance than any other style of appliance that could be used.

Fig. 4 is a view of the left side of the upper arch, in which the appliance on the case as made from a study model is shown. It will be seen that the lateral incisors carry a band which supports a small perpendicular tube. The

labial arch is a 17-gauge gold and platinum arch which was bent gingivally sufficiently far to lie entirely above the gingival border of the gum tissue. The object of an arch in this position is to make it less conspicuous and also to make it possible to use a labial spring extension spur of considerable length. The reason for using a labial spring extension spur of considerable length is to give an independent elasticity in the spur without disturbing the rest of the labial arch. The spur as used in this case was 22-gauge gold and platinum or elastic gold, but 24-gauge would more nearly fill the physiologic requirements because it would give an elastic spring which makes possible the exertion of

Fig. 3 Fig. 4

force upon a lateral incisor without disturbing any portion of the labial wire.

By comparing Fig. 3 with Fig. 4 it will be seen how the lateral incisor has been moved to its proper position both as regards the movement of the apex, which can be judged by the position of the crown, and also the manner in which it has been rotated. Pressure was brought to bear upon the canine which assumed a prominent position by means of a spring extension which was soldered on the labial wire in front of the molar tooth. This labial extension to the

Fig. 5. Fig. 6.

canine was made long to provide an elasticity without disturbing any other part of the appliance. The upper left central incisor was slightly prominent which was reduced by means of a spring extension as shown in Fig. 4 which rests against the central.

This spring extension is tapered towards the occlusal which gives a greater spring or elasticity at the occlusal border and also prevents a displacement of the labial wire to the extent that would occur if the spur were the same size. Also the tapering of the labial spur renders the spur or extension less conspicuous in that it is the same diameter all the way from the gingival to the occlusal surface.

Fig. 5 shows the right side of the same case in which the position of the

right lateral also indicates the necessity of an apical movement, as well as a rotation. The band with the perpendicular tube was placed on the lateral and the same type of spring extension spur as used on the left side was also employed. By using the spring extension, shaped in a letter J, it makes possible a two-point contact on the labial surface of the tooth whereby rotation can be accomplished. The right canine needs mechanical assistance in order to help it assume its position, and this is accomplished by placing a band upon the tooth, carrying a small spur which can be seen in Fig. 6. A spring extension from the labial arch is caught on the spur and thereby exerts an occlusal force on the canine without disturbing the major portion of the labial arch.

The extent of the tooth movement is shown by comparing Fig. 7 with Fig. 2 which especially calls attention to the manner in which the lateral incisors have been rotated by the spring extension. The advantage of these spring extensions is that the long spring gives a great range of elasticity and makes

Fig. 7.

Fig. 8.

possible pressure upon the individual teeth without disturbing the labial arch. In order for this individual pressure to be possible, however, the extension spring must be of a small gauge. The advantage of placing the arch labially under the lip renders the appliance less conspicuous as shown in Fig. 8 which represents practically as much of the teeth as would show in the mouth. It will be seen that the entire tooth and the gingival border of the gum tissue can be exposed to view without the main labial wire showing. The only part of the appliance on the incisors which shows is the extension spur on the central, and the bands on the lateral incisors with the occlusal portion of the spring extension. As a result of this, the appliance is much less conspicuous than any other appliance used for similar tooth movements and it accomplishes the movement much more satisfactorily owing to the long range of elasticity and the independent adjustment which is possible in the spur extension.

THE THIRD MOLARS IN RELATION TO MALOCCLUSION

By Martin Dewey, D.D.S., M.D., Chicago, Ill.

THERE is probably no problem in the dental profession today, which has been the cause of so much discussion or which has led to such a variety of statements from every viewpoint as has that of the third molars. If the question is considered from a purely dental standpoint, one will find men who advocate that every third molar should be extracted as soon as possible, and others who are equally as positive that every third molar should be retained as long as possible. These are men who claim that the third molar has no possible use, and there are men who claim the third molar has a great use. Some claim it is only a source of annoyance, while others claim that it performs a very important function. The probabilities are that both are right in some instances, and that in no case will the same rule apply to all conditions.

We have seen the mouths of individuals that undoubtedly would be better off if the third molars were extracted, and we have also seen mouths in which the dental apparatus has been mutilated, the efficiency of which has been reduced by the extraction of the third molar. Therefore, like a great many other problems in life, this can not be solved the same way in all cases. There is no question but that in the mouths of a great many individuals the third molars perform very important functions during the life of the individual, during the time all of the molars are retained, and in a great many instances, serve as attachments for artificial substitutes which could not be employed if the third molars were lost. In other mouths, we have found that just the reverse is true; that the third molar has not only been a source of considerable irritation, owing to the fact that it has not sufficient room in which to erupt, but it has also been a detrimental factor to the remaining teeth, and especially to the second molar.

There is probably no tooth in the mouth, unless possibly the first molar, which has such an unfavorable environment to contend with as does the third molar. The tooth extends over a long period of development and is influenced by environment to a great extent. In fact, most of the troubles which the third molars cause today are the result of the environment under which the tooth is forced to erupt. If man lived the same today as he did years ago, when the third molar had a positive function, these teeth, in all instances, would perform valuable functions today. It is a known fact that man is not living the same as he formerly did, and environment has produced changes in the dental apparatus, as a result of which the third molar probably suffers as much as any tooth. We are also aware of the fact that it is a law in Nature that the organs have a tendency to reassert themselves even after their usefulness is lost. This is true in a great many instances with the third molar. In other words, we will find individuals who develop a normal dental apparatus in which there is sufficient room for all of the teeth except the third molar and still the third molar will persist in developing. There then will be one of two things occur. The third molar will become impacted because of lack of room behind the second molar, producing a series of inflammatory disturbances or patho-

logic conditions, or it will assert itself and under the stimulation of growth will make room for itself by crowding or causing the other teeth to travel forward, resulting in a bunched condition somewhere in the anterior teeth. The question as to what effect the third molars have on the dental apparatus has been asked a great many times by the dental profession and by a number of orthodontists.

For a number of years the orthodontic profession was divided in regard to the effect of the third molars upon the existing anterior teeth. Some men claimed that the eruption of the third molar produced bunching in the incisor region while others contended that an erupting third molar would not have sufficient force to change the position of the teeth, to cause a drifting of the teeth, and, therefore, the only effect that would occur would be an inflammatory condition or an impacted third molar. Both of these conditions have probably existed in some cases, in fact, we are sure they have. At the present time, the question can be answered both ways. In some instances, the erupting third molars, or the third molars in attempting to erupt simply meet with an interference which causes an impaction with the second molar and cause pathologic conditions which are limited to the region of the third molar or to nervous reflexes. In other instances the erupting third molars will crowd the anterior teeth forward, causing a bunching either in the premolar or incisor region. In the majority of instances, the bunching occurs in the incisor region owing to the fact that the incisors are held in the line of the arch only by proximal contact. If a sufficient force be exerted on the posterior side of the dental arches, carrying the posterior teeth forward, some of the incisors will slip past the proximal contact point and consequently there will be a bunching. This condition has been observed in the practices of a number of men, and it has been observed in enough instances so that it may be considered a fact.

However, this is not a new observation, as we find in reading Weinberger's "History of Orthodontia" that he quotes from James Robertson who wrote in the *Dental Review, of London,* in 1859 on the "Cause of Irregularity of the Teeth" and mentioned the effect of the third molar upon the dental apparatus. Robertson says: "The growth and advent of the dens sapientiae, or third molars, when an insufficient space exists for its deevlopment is not only a source of great suffering, but frequently the immediate cause of irregularity by the pressure exerted toward the anterior teeth of the mouth which until their development presented a regular denture." We therefore find that James Robertson, in 1859, discovered that erupting third molars were a source of annoyance and were a direct etiologic factor in the production of malocclusion.

We find that the men who have been engaged in the practice of orthodontia for a number of years and who have been able to observe their cases during a considerable length of time have been impressed with the fact that erupting third molars very often produce malocclusion. In conversation with Lourie and Burrill who have observed their cases for a number of years they both are very emphatic in the statement that erupting third molars have been the cause of a large number of malocclusions occurring in dental apparatus which up to that time had remained normal. It is very probably true that a large number of so-called failures in the correction of malocclusion has been produced by erupting third molars. If this is true the orthodontic profession must meet this

problem squarely or they will be confronted with the question as to "what is the use of regulating teeth before the eruption of the third molar if the third molar is apt to produce malocclusion again."

If we are honest with our clientele and warn them that the erupting third molars are apt to produce malocclusion, it is well to discourage a great many people from having malocclusions treated at what we know to otherwise be the ideal time. Therefore, the manner and method in which to meet the problem of the third molar is that every case should be radiographed before treatment in order to determine the position, size, and location of the third molar. They should also be radiographed at various intervals or at times when they are expected to cause trouble, and if the radiograph and other anatomical conditions indicate that there is not sufficient room for the third molar, something then must be done to relieve the impacted condition of the third molar. Just what should be done will be a question of operative technic upon which men will differ and which condition will differ in different cases; but with our present knowledge of orthodontics and improved mechanical methods, as well as improved methods in oral surgery, there is no case of impacted third molars which can not be successfully handled. The diagnosis is made by use of the radiograph in such a manner as to prevent bunching of the anterior teeth and also leave the individual with good molar occlusion.

In some cases, owing to other clinical factors, it may be more desirable to extract the second molar and save the third, while in other cases it may be desirable to remove the third molar. I have seen cases where, owing to other clinical factors, the third molar would be a more desirable tooth to have in the mouth than the second molar. In this case I certainly would advise saving the third molar and sacrificing the second. In other instances, I would recommend the removal of the third molar; and because of this, each case must be diagnosed upon its merits and each line of treatment decided according to existing conditions. I have seen third molars which were caught under the distal convexity of the second and which otherwise were more perfect anatomical teeth than the second molars. In such instances, I think it would be better for the individual, both from the masticating standpoint and from the operative standpoint, to sacrifice the second molars and bring the third molars up into position. In other instances where the third molar is a deformed dwarf tooth, abnormal roots lying in abnormal position, the sacrifice of the third molar, even if quite an operative procedure, would be much more desirable than the sacrifice of the second molar.

We find another factor in regard to the third molar which seems to be quite hard to explain, but nevertheless it seems to be a clinical fact regardless of what causes the condition. It is this: that in a large number of cases, in fact, all that I have observed where the first molars for some reason have been lost early in life, the third molar is always a large, well-developed tooth. Now whether the loss of the first molar has anything to do with the increase in size and normal development of the third molar is a question that is very hard to prove, for it is impossible to extract a first molar and still retain it.

Some may say that the third molars and the dental arch would have been well developed if the first molars had not been lost. This, of course, one can

not disprove. However, we know that the calcification of the third molar begins with the cusp and for a considerable length of time the cusp is calcified, resting upon the dentine papilla without the cusp being united to the central fossa and the developmental groove. As a result of this, pressure is produced or exists in the region where the third molar is developing, it is very likely that the dentine papilla will not have sufficient energy or sufficient growth force to cause the crown to develop to the full size or to the size it would providing that impacted or crowded conditions did not exist. In the extraction of the first molar, the second molar invariably tips forward, relieving the impacted condition of the third molar, gives the cells of the dentine papilla a chance to expand and develop with the result that the enamel caps of the cusps are carried apart; the enamel organ is given more room, with the result that the crown of the tooth becomes larger; and if the crown of the tooth becomes larger, the pressure on the roots is relieved and the third molar is a normal, large, well-developed tooth.

Knowing this to be the fact and in the face of modern knowledge, that a great many first molars which are badly decayed do not have the roots properly developed, and properly filled, we often wonder whether it would not be more of a practical proposition from the standpoint of the patient, if some of these first molars had been extracted early in life and the proper orthodontic procedures instituted to bring the second molars into upright positions distal to the second premolars and allow the third molars to develop to their proper size and either come or be brought up against the distal surface of the second molars.

I believe in a great many mouths a much more satisfactory masticating apparatus would have developed if that plan had been followed than if the first molar had been retained as was the common practice a few years ago. I am not advocating the wholesale extraction of the first molars; but I do believe as a practical consideration that must be dealt with, there is a question as to what is going to be the most beneficial to the patient rather than what is going to be the ideal condition and result in the end. I believe the patient is much better off with two molars well developed and in an upright position, those two being a second and third molar, than they are with three molars, one of them being the first molar with badly filled roots, the roots probably not fully developed, and a third molar which is striving for room behind the second. As a result of this, the orthodontists today are confronted with a problem in which their plan of treatment will have to be modified to meet existing conditions much more practically than it has in times past.

In beginning the treatment of a case of malocclusion at the age of seven, or, in fact, at any age, radiographs should be made of all the teeth to determine the condition of the roots of all the permanent and deciduous teeth and also radiographs to show the possible position of the upper and lower third molars. As the treatment progresses at various intervals, and during the early life of the individual, the case should be kept under observation and radiographs made at various periods to determine the progress of the eruption of the third molars. The time of retention or the length of mechanical retention will depend upon the manner in which the third molars are erupting. I believe that it is extremely

unsafe to take off retaining appliances on the lower anterior teeth at the time the third molars are erupting unless the radiograph reveals there is sufficient space for the third molar to erupt without any tendency to forcing the second and first molars, or the dental apparatus forward. If the third molar is only slightly impacted, it may be relieved or assisted to erupt by various mechanical devices, one of which is the ligature jack which was described by Lourie several years ago. If the radiograph reveals that there is absolutely insufficient room for the tooth, then there is a question of deciding some plan of treatment to make room which will invariably include the extraction of some tooth in the molar series. What tooth that is, will depend upon other conditions that exist in the individual and that can not be governed by any set rule.

However, the fact remains that the third molar is a factor in the production of malocclusion and it can be made a factor in the production of an efficient set of teeth and as a result of this must receive a great deal more attention than it has in times past.

Get Busy

Ye editor sat in his busy den,
Cussing, and saying, "I wonder when
The fellows who read my monthly screed
Will come to my rescue with word or deed.

"I'm working for them, and it should be WE.
Why should they all lay down on me?
Our interest is a common one,
But the toil is mine, and theirs the fun.

"Come, wake up, boys, don't be so slow,
For this magazine has got to go.
Give us an item, now and then,
From your active brain and your facile pen.

"This is not an organ filled with 'guff,'
With nothing but advertising stuff.
Give us your thoughts and experience, too,
That others who follow may learn from you,

"Of your trials great, and your triumphs grand,
From coast to coast in this favored land.
So now get busy. Come off the shelf,
For by helping others you help yourself."

—Charles H. Requa.

THE PRINCIPLES INVOLVED IN THE ECONOMIC READJUSTMENT OF DIETARIES*

By J. J. R. Macleod, M.B., Cleveland, Ohio.

THE basic standard of diet is its energy value. The energy value of the foodstuffs is the currency of dietetics. Just as in the barter and trade of commerce some common basis of exchange is necessary, something, that is to say, having a standard value with which the value of all other things can be compared, and by the use of which they can be bought and sold; so with food, in order to exchange one foodstuff for another in the dietary, some standard of relative values—some food currency—must be used. The basis of monetary currency is the dollar; that of food is the calorie.

This does not necessarily mean that the calorie, although itself a fixed value, is always of exactly the same dietetic importance, for just as in the monetary system the purchasing power of the gold dollar may vary in different countries, so in dietetics may the relative importance of the calorie vary with the foodstuff which supplies it. Thus, the ration of one individual may be quite inadequate or may be harmful for another. "Ae man's meat's anither man's poison." Quite apart from gratification of appetite, which, however, is a most important factor in food assimilation, the food consumed by each individual must be properly adjusted to meet his peculiar requirements. Besides its caloric value, therefore, certain other values for foods must be taken into consideration, but at the outset attention is called to the calorie.

A calorie is the unit of energy. It can be used to measure the expenditure of energy, whether this occurs as heat, or as mechanical work, or as electrical discharge, or as chemical reaction. To make this plain, consider the relationship between the expenditure of energy as motion and as heat in the case of a steam engine. When the engine is at rest, all the energy is dissipated as heat, but when it works, some of this heat takes the form of movement, the sum total of energy expenditure being the same whether the engine is standing still or is moving. The source of the energy given out by the engine is obviously the fuel which is burned in the furnace. Turning now to the animal body, the fuel which it burns is the food. Everything capable of burning outside the body is not suitable for the animal fuel, but only those substances which can be acted on by special types of reagents present in the animal, called enzymes or ferments, which have the function of loosening up and breaking apart into smaller molecules the large complex molecules of which food is composed. The smaller molecules then unite with the oxygen of the blood and become burned or oxidized and liberate their energy. The foods belong to three classes of organic substances: fats, carbohydrates, and proteins.

In order to find out how much energy is available in a fuel, it is necessary to burn it and measure the amount of heat which it gives out in the process. The measurement of the amount of heat is not, however, so very easy a matter

*From the Physiology Department, Western Reserve Medical School, Cleveland, Ohio.

to comprehend. It is not a question merely of increase in temperature, for it is obvious that there must be very different *amounts* of heat in an ounce and in a pint of boiling water; placed side by side in similar vessels the ounce of water will cool off much more quickly than the pint. This simple example indicates a basis upon which we may measure heat, namely, as the temperature multiplied by the volume or mass of water. The unit of such measurement is called a calorie, which is defined as the amount of heat required to raise the temperature of 1 kg. of water (2¼ lb.) through 1° C., or, roughly, 1 lb. H_2O, 4°F. In order to measure the caloric value of a fuel or foodstuff, we must, therefore, ascertain the degrees of temperature through which a known volume of water is raised by burning a weighed amount of substance in such a way that all the heat which it gives out is taken up by the water.

The apparatus for doing this is called a calorimeter, which consists, in principle, of a stout iron chamber, or bomb, into which a weighed amount of the fuel, or food, is placed and then filled with compressed oxygen. The bomb is tightly closed, placed in an outer vessel containing a known volume of water at a known temperature, and the fuel or food set on fire by an electric current. When 1 gm. (15 gr.) quantities of each of the three foodstuffs are burned in the calorimeter, the values are: protein, about 5.5; fat, 9.3; carbohydrate, 4.1. That means, in the case of fat, for example, that if 1 gm. be burned in the chamber of a calorimeter, which, it will be assumed, contains 1000 gr. water, an increase of temperature amounting to 9.3° C. will be observed. No matter how slowly or quickly the given material burns, the caloric value is always the same.

To compute the total energy taken into the body, all we have to do is to weigh each article of food, ascertain from the numerous dietary tables readily available in textbooks, encyclopedias, government bulletins, etc., how much fat, protein and carbohydrate it contains, and then multiply each of these by its proper caloric value and add the results together. This gives us the caloric value available when the foodstuffs are completely burned. But some of the food is not entirely oxidized in the animal body, so that to determine the physiologic caloric value, we must subtract from the crude value the caloric value of the unused portion given out with the excreta. In the case of fats and most carbohydrates, the subtraction is very small if digestion and assimilation be in good order. It is considerable, however, in the case of protein, bringing the actual caloric value of this foodstuff down to 4.1, the same as for carbohydrates.

So far we have gone on the assumption that the caloric value of the foods will be the same whether they are quickly burned or only slowly used up in the life processes of the animal body. Obviously, however, before dietetics can be considered to rest on any scientific basis, indisputable evidence that such is really the case, must be furnished. The energy output of animals must be measured to show that it balances up exactly with the energy value of the food which has meanwhile been consumed. One of the greatest accomplishments of modern physiologic science is the fact that it should have been possible to do this very thing. For this purpose a calorimeter is again used, but modified so that it may be constantly ventilated to prevent suffocation of the animal. This is called a respiration calorimeter. It consists of an air-tight

chamber with double walls, in the space between which is an ingenious device by which the temperature of the air of the space is regulated so as to be exactly the same as that of the chamber itself, thus preventing entirely any loss of heat. The heat given off by an animal placed in the calorimeter is measured by observing the change in temperature produced in a known volume of water passed through radiators in the chamber, that which is meanwhile employed to evaporate the water given out in the expired air and sweat being readily computed by collecting this vapor in suitable absorption bottles (see p. 746) placed in the course of the ventilating tubes. Calorimeters have been constructed by Atwater, Benedict and Graham Lusk, in which a man can live comfortably for long periods of time.

The above comparison can not be made by merely measuring the food the animal eats, because the food is not necessarily consumed immediately after it is taken; it must first of all become assimilated in the body, and this takes some time. Months indeed may elapse between the time that a food is eaten and that when it is ultimately oxidized to yield energy. It is on this account that a starving animal may go on yielding energy; he lives on the foodstuffs which have been incorporated with his body; he feeds on his own tissues. The problem is not so simple as in the case of a steam engine, where we may compare the energy output with the fuel consumption.

How, then, is it known that each of the foodstuffs gives out as heat and other forms of energy the same amount of heat which it produces when burned in a calorimeter? The rate at which combustion is proceeding in the body must be measured by measuring the products of the combustion.

To understand properly the principle upon which such a measurement depends, turn for a moment to the conditions obtaining when a piece of sugar or fat is burned outside the body. As the combustion proceeds, carbonic acid and water are given off because of the union of the oxygen of the air with the carbon and hydrogen, of which elements, along with some intramolecular oxygen, either of these foodstuffs is composed. By the oxidation, energy is liberated as heat, so that the number of calories given out by the burning process is directly proportional to the amount of water and carbon dioxide meanwhile produced and the amount of oxygen used up. It is, chemically, a comparatively easy matter to measure the amounts of these combustion products. The carbonic acid is measured by finding how much alkali it can change into carbonate and by leading the air which contains it as vapor through substances, such as concentrated H_2SO_4, which absorb it. The analysis of proteins is more complicated on account of the fact that, besides carbon, hydrogen, and oxygen, they contain nitrogen. By suitable chemical processes this nitrogen has either to be dislodged from them, or converted into its hydrogen compound, ammonia, which is then very easily measured.

Let us see now how these methods of the chemist may be employed to measure the products of combustion in the case of an animal. For this purpose the chamber of the calorimeter is connected with an air-tight system of wide-bore tubes, along which an air current is made to circulate by means of a rotary blower or fan. The water and carbon dioxide given off by the animal are caught in so-called absorption bottles, inserted in the system and containing

suitable reagents to combine with the gases. The oxygen consumed by the process of combustion causes the volume of air in the system to shrink, but just as quickly as it does so, as indicated by a gauge, fresh oxygen is discharged into the system from a cylinder of the gas. In a chemical analysis, as we stated above, the water value, as well as that of carbon dioxide, is used in calculating the composition of the substance burned. In a metabolism experiment, however, as the above physiologic method is called, the water excretion is not of much value as a means of determining the amount of combustion, because of the fact that relatively large and inconstant amounts of it are taken with the food, and the body at different times contains varying amounts of it. The carbon dioxide excretion, taken along with the oxygen intake, is the important criterion. In short, then, by measuring the carbon dioxide absorbed by the absorption bottles and the fresh oxygen that has to be delivered into the system to keep the volume constant, one can tell exactly how much material containing carbon and hydrogen is being oxidized in the body.

When we know how much carbon has been oxidized, we can not tell how much of it came from protein, fat, or carbohydrate, because all three contain it; and the energy value of each being different, we can not compute how many calories have *in toto* been liberated by the combustion process. To find out what foodstuff was actually consumed, some other excretory product that is peculiar to one or the other of the foodstuffs must be observed. In the case of protein, this is made possible by the fact that the amount of nitrogen which the animal excretes during his stay in the chamber can readily be measured. Having found from the nitrogen excretion how much protein must have become used up (by multiplying grams of nitrogen by 6.25), we may then calculate the amount of carbon contained in this amount of protein and substract it from the total carbon which must have been burnt to produce the carbon dioxide. The remainder is the carbon of the fat and carbohydrate that have been burnt. The relative amounts of these two can then be computed from a knowledge of the relationship of the oxygen absorption to the carbon dioxide excretion—the so-called respiratory quotient.

Having thus become acquainted with the general principles of which the necessary measurements are made, the results are next to be considered. These are among the greatest achievements of modern medical science, for when the measurements are properly made, the caloric output as directly measured corresponds exactly with that calculated by multiplying the amount of each foodstuff, known to have been burned in the body, by its caloric value. This accurate correspondence of the *direct* and *indirect* methods of calorimetry has both a practical and a theoretic interest. It shows, for one thing, that there can be no energy either created or lost in the animal body that is not accounted for by the oxidation of the foodstuffs. It shows that no energy can be absorbed from the outside or new forms of energy created in the animal body. It proves the law of the conservation of energy for the animal mechanism.

And now with regard to the application of these extremely important facts in the science of *dietetics*. We are in a position to determine with scientific accuracy just exactly *how much food should be taken under varying conditions of bodily activity*. In a general way, we know that the amount of food that is

required is proportional to the nature and amount of bodily exercise that is being performed at the time, and that, if the food supply is inadequate, the work before long will fall off, not only in quantity, but in quality as well. "Horses (and men) work best when they are well fed, and feed best when they are well worked," is an old adage and one the truth of which cannot be overestimated in the consideration of all questions of dietary requirements. An ill-fed beggar will rather suffer from the pain and misery of starvation than attempt to perform the piece of work that the well-meaning housewife bargains should be done before she gives him the meal. The spirit may be willing but the flesh weak. If he could be trusted, he should be fed first and worked afterwards. Besides the amount of work, two other factors are well known to influence the demand for food, namely, growth and climate. A young growing boy will often demand as much if not more food than would appear, from a comparison of his body weight with that of his seniors, to be his proper share, and, other things being equal, it is well known that we are inclined to partake much more heartily of food during the cold days of winter than during the sultry days of July and August.

That we know these facts, in a general way, indicates that the first steps in the exact determination of dietetic requirements must be to find out how much energy the body expends under varying conditions of activity, etc. It must be plain from what has already been said that this may be done by having the person live for some time in a respiration calorimeter, so that we may measure the caloric output by both the direct and the indirect methods, the results of the one serving as a check on those of the other. To the conclusions drawn from results of observations made under such artificial and unusual conditions of living, the objection might, quite justly, be raised that they need not apply to persons going about their ordinary routine of life. To meet this objection another method, which we may call the *statistical,* is available. This consists in taking the average diet of a large number of individuals and comparing its caloric value with the average amount and type of work that they are meanwhile called upon to perform. This can be done in cases where the diet is accurately known, as in public institutions, the army, the navy, etc. The total food supplied is then divided by the number of individuals, this giving the *per capita* consumption. Obviously some get more than others, but when a sufficient number of individuals is included, such errors become eliminated by the law of averages. The close agreement between the results secured by these two quite different methods is a guarantee of the reliability of either.

Before proceeding to consider the results in greater detail, it is plain that, in order to make it possible to compare the energy output of individuals of different sizes, the results, that is, the caloric output, must be determined for some standard size of body. If such a standard were not used but we merely quoted the results as so many calories given out during each hour or day, we should, of course, find that a small child gave out far less energy than a large full grown man; we should fail entirely to bring out the fact, which is of great significance, that relatively to the size of their bodies the child gives out considerably more energy than the adult. The standard usually employed is that of body weight, the kilogram (2¼ lb.) being the unit. During recent years, however, it has been claimed that a more accurate basis of comparison is the unit of body sur-

face, the square meter; but with the reasons for this change of standards and the controversial matters which have been raised in connection with them, we need not concern ourselves; for the purposes of a scientific study of the principles which govern dietary requirements, the body-weight standard is the most suitable to adopt at present.

Let us then consider the caloric output of a healthy man of average weight (70 kg.). In the first place, it must be measured while he is at perfect bodily rest, lying quietly in bed, and at such an interval of time after taking food that the digestive organs are inactive. This is done by having him sleep in a bed placed in the respiration calorimeter and measuring the caloric output the first thing in the morning when he awakes. Under such conditions it has been found that 1 C. per kg. per hour, or $1 \times 70 \times 24 = 1680$ C. per diem, is produced. At first sight this result would seem to indicate that food containing an amount of protein, fat and carbohydrate capable of yielding 1680 C. would meet the daily requirements, but such is not the case. More must be given to allow for the fact that the physiologic processes involved in the assimilation of food by the tissues, quite apart from anything else, causes some heat to be dissipated from the body. This property of food has been clumsily called its *specific dynamic action,* and it varies according to the nature of the foods, being largest in the case of protein and smallest in the case of carbohydrate. As a rough estimate, it is usually considered that the average daily diet has a specific dynamic value amounting to ten per cent of the resting caloric output, giving us therefore, for a resting man living on an average diet, a daily caloric output of $1680 + 186 = 1848$ C.

The further expenditure of calories depends entirely on the amount of muscular work done, and much interesting information has already been collected, showing just how many calories are set free in the performance of different types of work. It is significant that, with their far-sighted appreciation of the value of science in the welfare of the state, the German authorities should some years ago have appropriated considerable sums of money for just such investigations, and that the data should have served as one of their main guides in the apportionment of food to the people. The government, as soon as it saw the possibility of a shortage, placed the control of food in the hands of scientific food experts without permitting such a vital question to be trifled with by legislators whose knowledge of food values is as shallow as their knowledge of how to play obstructive politics is profound. The delay that has attended the passage through Congress of the bill for food control is all the more provoking when we consider that in our country, and ready to serve voluntarily, are men who have convincingly shown themselves to be second to none in the world, not only in the scientific knowledge which must guide, but also in the executive ability which must administer, an efficient food control.

It has been found that if the person instead of lying in bed be made to sit still in a chair in the calorimeter, his caloric output increases by about 8 per cent, and if besides this he be made to do such work as writing at a desk, it will increase by nearly 30 per cent. A little simple arithmetic thus shows us that for such work the caloric expenditure per hour while the man is doing such work will increase from 77, which we saw to be that of basal heat production and the specific dynamic action of the food, to 97 C.; and if he does such work for six-

teen hours and sleeps eight hours, this gives $8 \times 77 = 616 + 16 \times 97 = 1552 = 2168$ C. A great increase in caloric output is created by walking, even on the level, and it has been quite clearly shown that the difference between the value which we have arrived at, viz., 2170 C., and the actual caloric expenditure of 2500 C., which from statistical studies is known to be expended by individuals doing a light day's work, can readily be accounted for by the walking incidental to moving from place to place in the daily routine.

Coming now to the results of the statistical method, the reliability of this method is testified to by the remarkable correspondence in the caloric values of the food consumed by farmers in widely different communities:

	Calories
Farmers in Connecticut,	3,410
" " Vermont,	3,635
" " New York,	3,785
" " Mexico,	3,435
" " Italy,	3,565
" " Finland,	3.474
Average,	3,551

(Lusk: The Fundamental Basis of Nutrition)

The average inhabitant of various cities:

London,	2,665
Paris,	2,903
Munich,	3,014
Königsberg,	2,394

(Rubner)

Individuals in different callings:

Farmers' families (U. S. A.),	3,560
Mechanics' " "	3,605
Professional men's families (U. S. A.),	3,530
Army (U. S. A.),	3,851
Navy "	4,998

(Atwater)

In general it is usually computed that a man weighing 70 kg. requires in calories:

2,500 for a sedentery life.
3,000 for light muscular work.
3,500 for medium muscular work.
4,000 and upwards for very heavy toil.

(McKillop)

These figures apply to the average man, but in calculating the caloric requirements of a family or a community allowance must be made for the lesser requirements of women and children. Several dieticians have compiled tables showing how many calories are expended according to age and sex, and the German authorities have recently taken these figures from them and calculated a generalized mean, which shows in comparison with men the percentage that should be allowed for women and children. The figures are as follows:

Man,	100
Woman,	83
Boy over 16,	92
Boy, 14-16,	81
Girl, 14-16,	74
Child, 10-13,	64
Child, 6-9,	49
Child, 2-5,	36
Child, under 2,	23
	(McKillop)

In calculating the caloric requirement of the population as a whole, the necessity of making allowance for the varying needs of men, women and children would obviously make the calculations far too complicated for practical purposes. It is necessary to have a factor by which we may multiply the total population in order to determine its *man value*. This factor is based on the relative proportion of men to women and children, and it amounts very nearly to 0.75; i. e., three quarters of the total population gives "the man value." Knowing the total population, say, of a city, we must therefore multiply this by 0.75 in order to ascertain for how many men doing moderate muscular work (3000 C.) food has to be provided.

Although the first step in estimating the dietary requirements of a family or community is thus to ascertain how many calories are expended by each individual and then to find suitable foodstuffs that will supply this amount, it must not be imagined that we have thereby fulfilled all the conditions to be considered in drawing up a correct dietary. There are many other factors to consider, and these, for simplicity's sake, we may divide into two groups: first, those pertaining to the chemical nature of the foodstuff, and secondly, those pertaining to its palatability, digestibility, and availability.

To appreciate the importance of the *chemical nature of foods,* it will be well to return to the analogy of the animal body with a steam engine, not because we shall find that the analogy becomes any closer, but, because it so entirely breaks down in one important particular that it becomes of value on this very account. The fuel of the engine is fuel alone; it is used for no other purpose, whereas the food of an animal, besides being fuel, is also used to repair the tissues of the body which have become broken down on account of the constant wear and tear to which they are subjected in carrying on the processes of life. The next step is, therefore, to find out the relative importance of the foodstuffs in supplying material for the reparative processes in the tissues. Biochemical investigation has shown that these are composed of the same classes of chemical substances as the foods—proteins, fats, carbohydrates, salts, and water—and that proteins occupy the most important position, since the greater part of the living tissue is composed of them; namely, the cell and its nucleus. Some fats or fat-like substances are also associated with protein in the construction of this vital tissue machinery, but by far the greatest bulk of the fat found present in the body merely represents storage fuel deposited, not in, but between the really active or vital tissues. Some carbohydrate is also probably used to construct the machinery, but by far the greater proportion is used for fuel purposes; indeed, carbohydrate is the most readily available of all the foodstuffs for purposes of producing energy. There is no large store of carbohydrate in the body, because it

is quickly consumed, whereas fat may be stored away for some considerable time before it is ultimately used as fuel material. Standing distinctly apart from the others in dietetic importance, therefore, is protein. With this foodstuff alone, many animals can exist, although they may not thrive, whereas with fats and carbohydrates as the sole foodstuffs, life is impossible. Protein in the diet is a *sine qua non* of life, because it is more than a mere fuel: it is also the essential building material for the worn out tissues.

This unique position of proteins has, in a general way, been appreciated for many years, but, apart from the fact that, of all foodstuffs, proteins alone contain nitrogen, so little was known concerning their chemical structure that, with the exception of gelatin, all proteins were thought to be of much the same dietetic value. Thanks to the advancement of biochemical knowledge, it is now known that this view is very far from being correct, for proteins differ in their chemical structure and in their dietetic value. The differences are dependent upon the nature and proportions of the various groups of smaller molecules of which the highly complex and very large molecule of protein itself is composed. To make this clear, let us imagine the protein molecule as a completed building with its stone and lime, its woodwork and plumbing, its plaster, and so on. It is composed of a great variety of building materials; but in a row of buildings no two need be exactly alike (although the same materials in general are used in their construction); some of them may have no stonework, others no plumbing, and even in those which use all of the available materials, the relative quantities used will vary considerably. So with protein: it is built up of innumerable building materials belonging to the class of chemical substances known as amino acids, that is, organic acids whose acidity is practically neutralized by the inclusion in the molecule of an ammonia residue, called the amino group. There is a great variety of such amino acids, some comparatively simple and others highly complex, since they contain, besides the organic and amino group, other chemical groups that are often of highly intricate structure.

To know the name and structure of each of these protein building materials, or amino acids, is not necessary for our purpose here, but there are two or three that we must at least mention in order to be, later on, in a position to understand why certain proteins should be more valuable than others as foodstuffs. These are lysin, containing two ammonia groups; tyrosin and tryptophan, containing a so-called aromatic group; and cystin, containing sulphur. The protein of muscle, for example, is not composed of exactly the same variety and proportion of amino acids as that of egg white. Even the proteins of the same tissues of different animals may not be exactly the same in their amino-acid consistence. It is evident, then, that if, on account of wear and tear, the tissues should require certain amino acids with which to reconstruct their protein, the supply can be insured only provided the food contains proteins yielding these particular amino acids. In the process of digestion the proteins become broken down into the amino acids, which are then absorbed into the blood. The most perfect protein food would thus be one containing all of the amino acids found present in the proteins of all the tissues, for then each tissue could select from the blood the exact amount of each of the amino acids it required, and what one tissue did not require the others might make use of. In this manner all

of the amino acids of a protein foodstuff might theoretically be used as building material for worn out tissue protein; but such a perfect adjustment between supply and demand does not actually occur, there being always a surplus of some amino acids, just as there would surely be some building material unused from a wagon, initially filled with every variety, after it had supplied to each one of a row of houses the materials required for repair purposes. This rejected building material has to be got rid of from the body, and this is accomplished by the amino acid being split up into two parts, of which the one is burned to yield energy, and the other, consisting of ammonia, is excreted in the urine as urea.

The proteins that contain all of the essential amino acids, though in varying proportions, are those of animal origin, such as the casein of milk and the albumin and globulin of blood, eggs, and muscle. Certain vegetable proteins, such as are present in part at least in the soy bean, hemp seed, Brazil nut, maize, and wheat (glutenin), also contain all of the necessary amino acids, though not in such suitable proportions as in proteins of animal origin. These may be designated as vegetable proteins of the first quality. Other vegetable proteins, such as those of beans, peas (legumin), part of the protein of maize (zein) and wheat (gliadin), etc., on the other hand, are wanting in one or more essential amino acids and may be designated as of second quality.

These facts have been ascertained by actual chemical analysis of the proteins, and their relationship to the building up of tissue proteins has been demonstrated by observing the rate at which young animals grow when fed on different proteins. During growth it is plain that the building-up process in the tissues is occurring in exaggerated form, so that by observing the weights of the animals from day to day the rate of the process can be measured. It is no doubt the case that proteins which are inadequate for growth, will also be inadequate for the repair of broken-down tissues in the adult. By taking a piece of paper ruled in squares and placing the weights of the animals on the horizontal lines and the days of observation on the vertical, we obtain what is known as *the curve of growth.*

Many of the earliest observations were made on young rats and mice. To eliminate individual errors large numbers of the animals were used, all of them being fed on a uniform diet of carbohydrates, fats, and salts, to which was then added the particular protein whose influence on growth it was desired to investigate. Large numbers of animals were used in each group, so as to eliminate individual peculiarities and accidental errors. Fed on the basal diet alone, the animals did not live for more than a few days. If protein of animal origin, such as the casein of milk or the albumin of milk or egg, or blood were added, however, the curve of growth was exactly like that of a normal animal. The proportion of protein that had to be given to attain normal growth varied considerably in different animals. In the case of white mice 25 per cent of the total calories had to be given as protein; rats required 15 per cent, and man seems to need only 7 per cent, this being the proportion in human milk on which alone the human infant thrives. With vegetable proteins, such as the glutenin of wheat and maize (Indian corn), which contain all the amino acids, normal growth could also be secured, but more of the protein had to be given than was the case with animal proteins, because some of the amino acids are

not present in adequate amounts. With vegetable proteins in which certain amino acids were missing, however, the animals did not grow at all. Thus, with one of the proteins of maize known as zein, the curve of growth actually descended, showing that the animals must soon have died of starvation. Chemical analysis shows that two essential amino acids are wanting in zein, namely, lysin and tryptophan. By adding pure tryptophan along with the zein, a distinct improvement was noted in the curve; it no longer descended, but remained practically horizontal, indicating that now, although incapable of growing, the animals were being at least maintained. Evidently, then, proteins must contain tryptophan if they are to prevent starvation. If lysin, as well as tryptophan, were given along with the zein, the curve of growth became normal, that is, it became the same as that obtained when perfect proteins such as casein are fed. Lysin, therefore, must be an important amino acid for growth, and it is of great significance that there is a high percentage of lysin in all those proteins that are concerned in nature with the growth of young animals; thus, it is present in large amount in casein, lactalbumin and egg vitellin.

The condition of the animal that has been fed on inadequate proteins is of great interest. When the aromatic amino acid, trytophan, which, as we have seen, is essential even for maintenance, was absent, the animal soon passed into a serious condition of malnutrition. Its fur became ruffled, its eyes inflamed, its feet cold, and it remained in a condition of torpor. By adding tryptophan to the diet, these symptoms immediately disappeared, and the animal became perfectly normal in every respect except that it failed to grow. It remained healthy but stunted. A most interesting question here presents itself, namely, has the power to grow become lost, or has it merely become suppressed by the absence of lysin? It is of great significance that growth merely becomes suppressed, for when the stunted animal was given a perfect protein, such as casein, it immediately began to grow with great rapidity, and soon attained the size of its now full-grown brothers and sisters.

Although it is particularly the vegetable proteins that are likely to be deficient in essential building stones, certain animal proteins, such as gelatin, are also lacking. Gelatin, like zein, contains no tryptophan, and like zein, it can not, therefore, maintain life. It is not a true protein but it is a valuable adjunct to protein food, because it contains many useful amino acids.

It should be emphasized that in wheat and maize besides the imperfect proteins, gliadin and zein, there is also another protein that is of first quality, namely, glutenin. This is present in sufficient amount to make even strictly vegetarian diets perfectly safe, provided enough of either of these cereals is taken to allow for the fact that only a part of the protein is of first quality.

Now it will be asked, how are we to make certain that suitable variety of protein building stones is present in the diet? The answer is that there is little chance of inadequacy in this regard provided several varieties of protein food are given. "Provide sufficient calories and let the proteins take care of themselves," is a perfectly safe rule to work by, provided animal proteins are used. Real danger from protein starvation could arise only in the case of strict vegetarians who did not take a sufficiency of wheat or corn, for, although other vegetable proteins than glutenin do contain all of the essential amino

acids, yet they may be deficient in this regard, and it would be decidedly risky to attempt to live on them alone. Strict vegetarians are, therefore, liable to run the risk of partial starvation. One of the most valuable of proteins is probably casein of milk; another vitellin of egg yolk. A glass or two of milk with an egg, along with vegetable food, makes the diet a safe one, provided always, of course, that the caloric requirements are met, and that no excessive wear and tear of the tissues is going on.

But it is probable that such a diet is inferior to one containing a proper, but not excessive, amount of animal proteins. It has been found that the smallest amount of protein required to maintain nutritional equilibrium is secured by taking flesh food, along with abundance of carbohydrate and fat, because obviously this, in its amino acid make-up, comes closest to that of the animal's tissues.

These considerations lead to the question: To what extent may the proportion of protein in the diet be reduced with safety? It is evident that there must be a minimum below which every one of the necessary building materials of protein would not be supplied in adequate amount to reconstruct the worn-out tissue protein.

The extent to which the protein content of the diet of man can be lowered with safety depends on several factors, of which the most important are: first, the nature of the protein; secondly, the number of nonprotein calories; and thirdly, the extent of tissue activity. Where so many factors must be taken into consideration, the only method by which the actual minimum can be determined consists in what may be called "cut and try" experiments. Of the many investigations of such a nature, probably the best one is that recently published from the Nutrition Laboratory of Copenhagen. The subject, an intelligent laboratory servant, lived a perfectly normal and active life for a period of five months on a diet of potatoes cooked with margarine and a little onion, and containing 4000 C., with a total protein content of 29 grams. During another period he did outdoor work as a mason and laborer, and took 5000 C. daily, and 35 grams protein. Many other experiments of a similar nature make it certain that man can lead a normal existence and remain in good health on very much less protein than the 100 grams which statistical studies show to be the amount which he actually takes. This discrepancy between the amount which experiment demonstrates to be adequate and that which habit and custom demand, raises the question as to whether, after all, our instincts may not have erred and so made us unnecessarily extravagant in our protein intake. It has been suggested that such protein extravagances, will in various ways, have a deleterious effect on the organism; thus, that the excretory organs, such as the kidneys, will be overtaxed in eliminating the unused amino acids, that the constant presence of the bodies in excess in the blood will cause degeneration and sluggish metabolism, and that the excess protein in the intestine will lead to the production of ptomaines, whose subsequent absorption into the blood will cause toxemic symptoms.

Important support to such views appeared to be supplied some dozen years ago by Chittenden, who was able to show that he himself and many other persons doing different kinds of work could be supported on daily amounts of

protein that were not more than from one-third to one-half of the amount usually taken. Not only so, but it was averred that distinct improvement was experienced in the general sense of well-being and of mental efficiency as a result of the lesser protein consumption.

Taking these results as a whole, it is quite clear that man can get along under ordinary conditions with much less protein than he ordinarily takes. This really proves nothing, for the question is not *can* he, but *should* he so deprive himself. Are instincts and customs wrong, and is Chittenden right?. That is the question. To answer it many studies have been made of the condition of peoples who for economic or other reasons are compelled to live on less protein than the average. Are these people healthier, less prone to infections and degenerative diseases, and more efficient mentally than others? In such studies great care must be exercised to see that conditions other than diet, such as climate, exercise, etc., are properly controlled. It would not, for example, be fair to compare the mental and bodily condition of peoples living in the tropics and who take comparatively little protein, with those living in temperate zones, who consume much more. After discounting all of these other factors, it has been quite clearly shown that, when the protein allowance is *materially reduced,* the people as a whole are less robust, mentally inferior and, instead of being less prone to the very diseases which are usually supposed to be due to overloading of the organism with useless excretory products, they are more liable to suffer from them. That a considerable reduction in protein weakens the defense of the organism against infection is probably due to the fact that the fluids of the body normally contain a great variety of so-called antibodies, that is, of highly complex substances that are largely protein in nature. When bacteria, or the poisons produced by them, enter the body, they are met by one or more of these defense substances and destroyed or neutralized. Now it is clear that there should always be a surplus of protein building materials from which these antibodies may be constructed. Such an excess will constitute a "factor of safety" against disease. And there are factors of safety of another nature to be produced, two of which we are in a position to appreciate. In the first place, there must always be an adequate supply of tryptophan, of lysin, and of cystin, not only to meet the bare necessities of the protein constructive processes that go on under normal conditions, but also to make good the larger amount of protein wear and tear that greater degrees of tissue activity will entail. Although moderate muscular exercise does not appear to cause any immediate consumption of protein (carbohydrate and, later, fat being the fuel material used to produce it), yet it does throw a greater strain on the tissues, a greater wear and tear of the machinery, and hence a demand for more protein building material. In the second place, there are certain of the internal secretions of the body, such as epinephrin (adrenalin), which are essential for life, and as crude materials for the manufacture of which certain amino acids are essential. Tyrosin is one of these, and since, as we have seen, proteins differ from one another quite considerably in the amount of this amino acid which they contain, it is advisable to provide an excess so that an adequate supply of tyrosin may always be available.

The answer to one of the most important practical questions in dietetics, namely, "What proportion of protein should the diet contain?" depends on these scientific principles. The source of the protein is the important thing. With animal protein there is no doubt that we could get along with perfect safety by taking daily not more than 50 to 60 grams, which is about half of what we actually take. If the protein be of vegetable origin and of the first quality, such as is contained in wheat and maize preparations, more should be taken, because of the fact that the protein in these cereals is only half of the first quality. When vegetable proteins of the second quality, such as those of peas, beans, lentils, etc., are alone available, much larger amounts are necessary. Such proteins are inadequate in the case of growing children at least, and even in adults it is undoubtedly advisable that other proteins should supplement them.

To insure safety, therefore, it is almost imperative that the diet should contain *proteins of various sources.* If for economic reasons the main source must be proteins of vegetable origin, then some animal protein, such as is contained in milk or meat or eggs, should be added to at least one of the daily meals. Thus, when peas and beans are mainly depended on for the protein supply, they should be taken either with milk or one of its preparations, or with a thick gravy or sauce made from meat and containing the finely minced meat. This must not be strained off, for if it is, the sauce will contain only the meat extractives but not any of the protein, for these are coagulated by the boiling water. Meat extract, in other words, contains no proteins; it is not a food but merely a condiment of no greater dietetic value than tea or coffee.

The question has been asked, "What should we take in place of meat if one or two meatless days have to be introduced in order to conserve the food supply?" The answer is that milk and eggs will completely make good the deficiency, or if these also be unavailable, then the taking of a more liberal supply of wheat or maize preparations will be satisfactory. Protein deficiency for one or two days a week could, however, scarcely entail any risk to health provided the usual allowance of animal protein or of first quality vegetable protein be allowed on the other days. The value of potato protein should be remembered in this connection. In any case the attempt should always be made to give a variety of proteins. That the animal economy prefers, if it does not demand, such a mixture even if the best varieties of protein is indicated by the fact that milk, the perfect food for early growth and development, contains two such proteins—casein and albumin.

Regarding the relative quantities of fats and carbohydrates, the usually accepted figures are: fat, 80 grams (3 oz.); carbohydrates, 400 grams (14 oz.); that is, a ratio of 1 to 5.

Even when the calories and the protein are correct, the diet may be inefficient because of absence of minute quantities of peculiar substances of unknown composition. These have been called vitamines, but this is a most unfortunate name, since an amine is a well characterized chemical substance, whereas these "accessory food factors," as they are better called, are not.

Failure of nutrition due to the absence of accessory food factors is really no recent discovery. It was known to sailors in the bygone days of sailing vessels that despite a liberal allowance of well-mixed preserved food, a long voyage was almost certain to lead to the development of ill health, despondency, and incapacity for work, or perhaps of the disease, scurvy, itself. The discovery was, however, made by the famous Captian Cook that this unhealthy condition of his sailors could be relieved by compelling them whenever possible to go ashore and eat of the fresh foods, either animal or vegetable, that might be available. It was perfectly clear that such foods contained something of great benefit to health that was lacking in the ship's galley. The giving of orange or lemon juice in certain cases of malnutrition in children has also been known for some time in medical practice, but the impetus to a more searching investigation of the nature of these unknown accessory food factors was given by the discovery that the curious disease called beriberi, often observed in certain tropical countries, was associated with the taking of polished rice in place of the less popular grain still having some of the husk attached. This observation led to a systematic investigation of the association between this and the analogous disease which develops in pigeons when these birds are fed exclusively on polished rice. It is found that the addition to the polished rice of an alcoholic extract of the husks very promptly removed the symptoms, and that other things like yeast had a similar effect. Several investigators attempted to isolate this vitamine, as they called it, in pure condition, and thus determine its exact chemical composition, but with little success. Among the most careful of these investigations are those of McCollum, who has come to the conclusion that there are at least two accessory factors concerned, one of them soluble in fat and present in adequate amount in butter and other animal fats, but not in vegetable oils, and the other soluble in water and present in wheat, vegetables, fruits, etc. Milk contains both of these factors, so that its inclusion in a diet is a safeguard, not only against inadequacy in suitable protein, but also against the absence of accessory food factors. There is little danger of the diet being inadequate with regard to food factors if it contain some fruits or green vegetables or unheated fresh milk. The food factors are destroyed by prolonged cooking.

Digestibility and Palatability.—No matter how perfect in calories, protein, and accessory food factors a diet may be, it will fall short of being really adequate if it is not properly assimilated. It is the function of the digestive apparatus to break up the highly complex molecules of protein, fat, and carbohydrate sufficiently to permit them to pass through the lining membrane of the intestine into the blood and lymph. This disintegration is effected by the digestive ferments which are contained in the digestive juices. Of these, saliva, the gastric juice, and the pancreatic juice are best known. In the cases of protein and carbohydrate, the activities of the ferments are interdependent, in the sense that the foodstuff must be acted on by the ferments in a definite order. One ferment prepares the foodstuff for the action of the next. Without this preliminary treatment the second ferment can not properly unfold its action. The conditions are like those existing in a factory where the products

of one department are further worked up in another, which then hands on its product to a third and so on.

These facts indicate that for efficient digestion it is essential that the *initial* digestive juice be secreted in proper amount and at the proper time. The first digestive ferment which acts on protein is the pepsin of gastric juice. A fundamental question in dietetics is: On what does the secretion of this juice depend? The answer is: On the gratification of appetite. No one, judging from his own experience, will probably deny the correctness of this answer, for we all know that unappetizing food is likely to be followed by a sense of gastric discomfort, if not by symptoms of indigestion. Are there, however, any scientific observations from which the true value of this factor in the initiation of the digestive process can be appraised? Thanks to the brilliant work of the great Russian physiologist, Pavlov, we have such information. Pavlov's experiments were made on dogs, but the results have been shown, particularly by Carlson, to be very similar in the case of man. The observations were made on animals in which an artificial opening or fistula had been made into the stomach. Through this fistula the secretion of gastric juice could be observed, and it was found that very shortly after taking some savory food by the mouth, a copious secretion of gastric juice was set up, and that this occurred even although the food after being swallowed was prevented from entering the stomach, by making a fistula in the esophagus. The experiment is called "sham feeding." Not only this, but a hungry animal would secrete the gastric juice even although the food was not actually placed in the mouth but merely offered to it. The anticipation of an appetizing meal, as well as the gratification of receiving it, can set up the flow. It is called the psychic or *appetite* juice. If the animal were not hungry or had no appetite for the particular food, no juice was observed to flow.

The pepsin in this psychic juice sets the ball of protein digestion rolling. Once started, this process goes on automatically, because the digestive products produced by the appetite juice have the power of directly stimulating the gastric glands to further activity, and when the food has been digested to a somewhat further stage, the stomach delivers its contents, in small quantities at a time, into the beginning of the intestine, where by again acting directly on the lining membrane it excites the flow of pancreatic juice, a ferment of which, namely, *trypsin,* carries the digestion to still another stage, until finally the protein molecule is sufficiently broken up to be attacked by the ferment *erepsin* present in the intestinal juice and intestinal mucosa. The whole process, therefore, depends for its proper accomplishment on the appetite juice. It is like a fire: the psychic juice is the kindling material; when it is ignited, the combustion goes on automatically, one stage leading to the next. Some substances, such as the so-called extractives of meat, act like partially digested protein in directly stimulating the secretion of gastric juice.

We have seen that practical dietetics depends on several factors, the exact relative importance of which can not perhaps in every case be gauged, but preparation of the food so as to make it appetizing, must undoubtedly rank high. The importance of *good cooking* will now be apparent. It is the act of making

food appetizing and, therefore, digestible. It is really the first stage in digestion, the stage that we can control and one therefore to which much attention must be given, especially when it becomes necessary to make attractive articles of diet ordinarily considered common and cheap. Most people can cook a beefsteak or a lamb chop so as to make it reasonably appetizing, but few can take the cheaper cuts of meat and convert them into cooked dishes that are as popular and attractive. There are still fewer who can take the left-overs and trimmings and convert them in the same way. This is the real art of cooking, and too much encouragement can not be given to the effort which our cooking experts are making to show people how these things can be done. The waste of good food in a large city is appalling. An army could live off our garbage cans. I need not dwell on this most important phase of the food conservation problem. I would only add that every housewife who desires to do her "bit" in the present emergency can do so in no way better than by learning to use *all* the odds and ends of the kitchen in such a way that they can be offered as appetizing food to her household. It is worse than useless to dish things up unattractively, for under such circumstances food becomes poison.

Cooking has other advantages than making the food appetizing. The heat loosens the muscle fibers of the meat so that it is more readily masticated; it destroys microorganisms and parasites in the meat; it destroys antibodies which might interfere with the action of the digestive ferments. Thus, raw white of egg is not digested in the stomach because it contains one of the antibodies which prevent the pepsin from acting on it. Boiled egg white, if properly chewed, is digested, and whipping the egg white into foam partly destroys the inhibiting substance.

Before concluding, something should be said about the *laxative qualities of food,* for it is often in this particular alone that one food is more satisfactory than another. A diet of meat, milk, eggs, and white bread is apt to be unphysiologic because there is nothing in it to serve as what has been called intestinal ballast, that is, a material which will keep the intestines sufficiently filled to stimulate their muscular movements. This ballast is best furnished in the shape of cellulose, the most important constituent of green food. Peas, beans, cabbage, salad, and many fruits, especially apples, should always occupy a place in the daily menu. Another valuable food yielding this ballast is the outer grain of wheat, oats, etc. So much must not be taken as to produce a constant intestinal irritation, and each person must determine for himself where this limit lies. The difference between various breads is almost entirely in the degree to which they supply ballast.

APPENDIX.

It will be remarked that nothing is said in the foregoing article concerning the methods by which a given diet can be composed so as to supply the required number of calories. This is a detail which could be adequately discussed only by reference to extensive diet tables, the publication of which is unnecessary here. It may help if we give some rough and ready rules by which such tables may be satisfactorily used. As a type of diet table take the following:

FOOD	PROTEIN PER CENT	FAT PER CENT	CARBOHYDRATE PER CENT	CALORIES PER LB.
Average of beef, veal, and mutton	14.5	16.1	...	913
Pork	12	29.8	...	1477
Bacon	9.5	59.4	...	2685
Fish (general average)	10.9	2.4	...	295
Eggs (2 oz. in shell)	11.9	9.3	...	613
Milk (whole)	3.3	4	5	322
Cream (average)	2.5	18.5	4.5	908
Butter	10.	8.3	...	3510
Cheese	25.2	33.7	2.4	1950
Bread (average)	9.2	1.3	53.1	1215
Rice	7.4	0.4	79.2	1620
Legumes (dried average)	2.4	1.7-2.3	54	1500
Potatoes	1.8	0.1	14.7	310
Green vegetables	1.4	0.2	4.8	145
Fruit (average)	0.4	0.5	8.	180

(McKillop)

Having decided how many calories a day is required according to the principles laid down on page 747, proceed to weigh out each of the articles of food that it has been customary for the person or persons to take. If the calories do not correspond to the required number, add or subtract a proper amount of one or more foodstuffs, using the figures in the fourth column of the table for this purpose. Having adjusted the food allowance according to calories, proceed to see whether there is sufficient protein according to column 1 and the principles explained on page 756. The simplest way to do this is, first, to multiply the number of ounces of each foodstuff used by 28.4 (grams to an ounce), and then by the percentage figure given in the first column. The product divided by 100 gives the grams of protein. Finally calculate by the same method the grams of carbohydrate and fat, and see that they bear the ratio to each other of about 4 to 1.

Finally, it should be remembered that the above requirements refer to foodstuffs actually digested. In the case of protein, 10 per cent is usually subtracted from the crude protein in arriving at this figure. For fats and carbohydrates the figure is quite variable. The figures in the above table are also for raw materials. Where there is evident loss in cooking, proper allowance must, of course, be made.

BIBLIOGRAPHY.

The following recent small volumes are of great value at the present time:

The Physiology of Food and Economy in Diet, W. M. Bayliss, Longmans, Greene & Co.
Food Values; What They Are and How to Calculate Them, McKillop, G. Routledge & Sons.
The Fundamental Basis of Nutrition, Graham Lusk, Yale University Press.
Food Economy in War Time, T. B. Wood and F. G. Hopkins, Cambridge (England) University Press.

The International Journal of Orthodontia

PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 801-807 Metropolitan Bldg., St. Louis, Mo.

Foreign Depots—*Great Britain*—Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

Subscription Rates—Single Copies, 30 cents. To anywhere in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $3.00 per year in advance. Under foreign postage, $3.40. English price: 15/ per annum, 1/6 per number. Volume begins with January and ends with December of each year.

Remittances—Remittances for subscriptions should be made by check, draft, postoffice or express money order, or registered letter, payable to the publishers, The C. V. Mosby Company.

Contributions—The editor will be pleased to consider the publication of original communications of merit on orthodontic and allied subjects, which must be contributed solely to this journal.

Opinions—Neither the editor nor the publisher hold themselves responsible for the opinions of contributors, nor are they responsible for other than editorial statements.

Reprints—Since it is not desirable to hold type standing longer than absolutely necessary, all requests for reprints should be made at time of submitting manuscript for publication. Rate card will be sent with galley proof.

Communications—Contributed articles, illustrations, letters, books for review, and all other matter pertaining to the editorial department should be addressed to the Editor, Doctor Martin Dewey, 25 East Washington Street, Chicago, Ill. All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 801-807 Metropolitan Building, St. Louis, Mo.

Illustrations—Such halftones and zinc etchings as in the judgment of the editor are necessary to illustrate articles will be furnished when photographs or drawings are supplied by the authors of said articles.

Advertisements—Objectionable advertisements will not be accepted for publication in this journal. Forms close first of month preceding date of issue. Advertising rates and sizes on application.

Change of Address—The publishers should be advised of change of subscriber's address about fifteen days before date of issue, with both new and old addresses given.

Nonreceipt of Copies—Complaints for nonreceipt of copies or requests for extra numbers must be received on or before the fifteenth of the month of publication; otherwise the supply is apt to be exhausted.

Entered at the Post Office at St. Louis, Mo., as Second-Class Matter.

EDITORIALS

The Commercialization of Scientific Essays

IN a recent editorial we dealt with the commercialization of scientific societies, and we also had something to say in regard to commercialization of scientific essays in an editorial dealing with the object of orthodontic societies, as a result of which we have been questioned more in detail as to what we were referring to by the commercialization of dental and orthodontic societies. To be more specific, we will call attention to one particular phase of the subject in this editorial which deals with the commercialization of scientific essays and we will cite some instances in regard to conditions at the present time that look very bad for independent societies composed of thinking men such as are members of orthodontic societies.

A very good example of the commercialization of a scientific essay occurred in a very prominent dental journal last summer. There appeared in the first

pages of the dental journal an article describing a new style of appliance which had recently been patented. It was claimed that this appliance possessed wonderful virtues and advantages over anything that had ever been used, and the appliance was supposed to be described from a purely scientific and unbiased standpoint. The description of the appliance was written by the inventor. This condition was bad enough, but as the paper was not presented before a large independent society of orthodontists, that phase of the question can, to a certain extent, be overlooked. However, due to the fact that the article was published in a dental journal, which is published by a trade house and is supposed to represent the highest type of dental journal which the profession has at the present time, it was given great publicity, being published in the front pages. Some of the illustrations in the article showed the trade-mark of the trade house, and showed certain patented appliances which could only be obtained from the manufacturers, who were also the publishers of the trade journal. This does not look well from the purely scientific and independent standpoint. Another feature that would suggest that this essay had been commercialized, was the fact that in the advertising pages of the same issue of the dental journal there appeared an announcement that the manufacture of the appliance was under way and prices would be announced in the October issue of the journal by the manufacturers, who were also the publishers of the dental journal. In the advertisement, which was set in large bold type covering the entire page, the reader was referred back to the article on pages 969 and 994 of the journal. In other words, the essay that was supposed to be a scientific essay was nothing more than a smooth advertisement for the sale of the appliance.

While the author may not have written the paper with a view of selling the appliance, the publishers of the dental journal, who were also the manufacturers of the appliance and who paid the author a royalty for the use and control of the patent, were commercializing the paper by advertising it in the back part of the journal. In other words, the scientific (?) pages of the journal, which is supposed to be the most respectable dental journal in the United States, were made nothing but a clean, smooth, advertising sheet. This is a typical case of the commercialization of a scientific essay, and an insult to an independent, free thinking body of men such as orthodontists.

To make matters still worse, the manufacturing concern that is publishing the journal had reprints of the paper made and sent them broadcast, accompanied by a price list of the regulating appliance,—still the essay was called a scientific paper. It was still said to have been written in the interest of science; but it looks very much as if it were written in the interests of the publishers of the dental journal and the manufacturers of the regulating appliance.

A similar case of the commercialization of scientific articles, and one which looks bad from a purely scientific standpoint, is a series of articles which are being published in another trade journal, describing certain methods which are being advocated by the writer of the articles. The essays have been running through a number of the issues of the journal, and contain considerable information that is more or less of scientific value. The articles are very well written. However, there is in all of them inference to a certain method, which method is described in such a manner as to enable no one to use it. We believe

this scientific article loses a certain amount of its scientific value due to the fact that the scientific part appears in the advertising section of the journal. The advertisement describes a plan, or method, whereby the reader can avail himself of a certain amount of information which is described in the scientific article by consulting the essayist. In other words, a scientific article is published in the scientific pages of the trade dental journal, signed by the writer; while the advertising section contains a two page featured advertisement, signed by the same man, giving the same address that is given in the scientific article. We again contend that this is commercialization of what should be a scientific essay; and a scientific essay, to a certain extent, loses its dignity when confused and mixed up with the commercial advertisements.

Another example of the commercialization of scientific essays is found in the case of a paper, read before one of the oldest societies of orthodontists, describing a certain style of appliance. Later we were informed that the man reading the paper was interested in a patent that had a bearing upon the appliance he described. The essay was further commercialized by a demonstration of a certain style of commercial appliance which is sold by dental supply houses, and which is manufactured by a friend of the essayist. The appliance was illustrated for commercial reasons. The essayist did not illustrate that particular style of appliance because he thought it was the most advantageous, for we are told that the essayist later admitted, several months afterwards, that he had not used that particular style of appliance for several years before the paper was written. In other words, he allowed a scientific essay to be commercialized to the extent of exhibiting a style of commercial appliance which he did not use in his own practice because the paper might assist in selling the appliance. We contend that this is another example of the commercialization of a scientific essay, which only had a detrimental effect upon orthodontia, and which made the science of orthodontia appear ridiculous as compared to other sciences.

It is, therefore, time for orthodontia, as a science, and for orthodontists, as individuals, to pause and consider whether they are going to continue to allow themselves and their societies to be used as a furtherance of some particular patented regulating appliance, whether they are going to allow their literature to be dominated by dental supply houses that will allow anything to be published so long as it exists in the advertising section of the journal, or whether they are going to make a stand for clearer and freer journalism. Undoubtedly, orthodontists do not realize the seriousness of this condition.

Dental Hygienists

CERTAIN men in the dental profession have advocated for some time that there be some provision made in state laws that will enable dental assistants, or persons not regular licensed dentists, to perform certain dental operations in the mouth which are supposed to be confined to cleaning and scaling of teeth. It has also been advocated that there be some provision made for dental nurses, who should have a standing somewhat superior or above that of an assistant who has not had a definite course of training. As a result of this con-

tinuous cry from some men in the dental profession, certain state laws have been modified recently to enable dental assistants who have taken a certain prescribed course of study to perform certain operations upon the teeth.

Anyone who is familiar with the work done by the medical nurse will agree that the medical nurse has a position and a standing in the medical profession, and that she renders a great service. However, we do not believe that the dental nurse, the "dental hygienist," being advocated by some of the enthusiastic supporters, has the right to distinction or standing that the medical nurse has, for reasons which we will state later.

We shall also believe, as the editor of the *British Journal of Dental Science*, that the term "dental hygienist" is an unfortunate word. We of the profession have not been willing to permit a person who has received a short course of training to be called a dentist, yet provision has been made in some places to call them a "dental hygienist." This gives them some sort of a high sounding title which, to a certain extent, will confuse the public and make the public believe that the dental hygienist is something which she is not. We do not believe that anyone who has taken a prescribed course of study as outlined in so-called schools of dental hygienists or dental assistants is entitled to use the word "hygienist," because one versed in hygiene is certainly one that is versed in more than the scaling and cleaning of teeth. The word "hygienist" is applied to medical officers of health, men who have devoted years of training and study in medicine, and who have taken special courses in regard to sanitation. They have spent at least six years in the study of their profession and are entitled to be sanitary officers or hygienists, and now some of the dental profession come along and put the stamp of approval on the "dental hygienist" who has only a course of training of a few weeks.

We believe that the cleaning and polishing of teeth and treating diseased conditions of the gum is entirely too important a phase of dentistry to be turned over to an assistant who has only had a few weeks course, or to anyone who has not had a complete course of training in a dental college. In fact, we can say that the average line of training that is given in the dental college is not sufficient to enable the average dentist to properly treat, clean, and scale teeth. The work which is supposed to be delegated to the dental hygienist is entirely of too much importance to be left to one who has less knowledge than that possessed by the average dentist. We have previously stated that we do not believe the dental nurse as being advocated at the present time is qualified to take a position along with the medical nurse, in fact, we believe it is an insult to the medical nurse to attempt to give the dental nurse any such standing or rating when we consider the courses the two are obliged to follow.

The medical nurse, besides being compelled to have a high degree of preliminary education, is compelled to spend three years of constant service and study in a hospital, which are three of the most strenuous years that anyone ever puts in. Anyone who is familiar with the course of study that a nurse pursues in a modern hospital realizes that she has taken a course which very few dentists would be anxious to go through. The course which the dental nurses are supposed to take or the "dental hygienists" is very much inferior

and in fact may be considered a joke in comparison with the course which the medical nurse takes.

In this number of the Journal we review a book called "Mouth Hygiene," which contains a course of instruction for "dental hygienists." Out of this *single book* dental hygienists are supposed to receive all the necessary instructions to enable them to carry on their work. The fact that they are able to carry on their studies from the perusal of a single book again shows that the dental nurses have no standing or rating as compared with medical nurses. In further comparing the unsatisfactory and insufficient course that the "dental hygienist" receives, we will quote from the preface which may be considered as a standard of the course which dental hygienists are to receive. It says:

"These questions have repeatedly been asked: 'Where are we going to secure such women, educated and trained as dental hygienists? Where are they to secure such an education? What should constitute a course of lectures and practical training? Are there textbooks that they may study to comprehend and perfect themselves in this dental work?' "

You notice the word *perfect* is used, which is something that very few of us ever succeed in doing in our profession. The preface further states that the main object of this publication is to give a definite answer to these questions and introduce an educational course for the "dental hygienist" which will prove to be something definite and concise.

"In the fall of 1913 gentlemen whose names appear as contributors to this work were approached and asked if they would aid in such a cause, if they would come to Bridgeport and deliver their lectures to a class of thirty-two women, the lectures to be taken in shorthand, sent to them for correction and condensation so that the pith of the subject might be published in a textbook for the education of women assistants in prophylaxis."

You will notice that the education of women assistants in prophylaxis is to be obtained from a single textbook. We mention this not as defect in regard to the textbook, but as a defect in the system, thereby showing what insufficient education the dental hygienists are going to have and the great danger that is being forced upon the dental profession by some enthusiastic men who are in favor of dental nurses.

The preface further states that the course was given, that "the lectures were held in the evening on Mondays, Wednesdays, and Fridays, and with the exception of vacation at Christmas time, ran from November 17 until March 30," a period of slightly over four months in which these "dental hygienists" received lectures in the evening three days a week. "The class assembled at 7:30 P.M. and a review of previous lectures was taken up by one of the quiz masters. At 8 P.M. the lecturer of the evening commenced, and lectured until 9:30 P.M. or thereabouts."

It certainly seems to us that this is an insufficient course to give an individual to entitle her to be called a "dental hygienist" or a "dental nurse," and expect the public to give her any such a standing or recognition as is given the medical nurse. We are not opposed to dental nurses, but we do believe that a dental nurse, in order to have any standing and not be considered a joke in the dental profession, must have a course of training as scientific and complete as

that of the medical nurse. We do not believe that a dental nurse can be taught in four and a half months by receiving lectures three evenings a week which extend say from 7:30 to 9:30 P.M.

In further substantiation of the incomplete manner in which uneducated girls who are going to be forced upon the profession as "dental hygienists," we call attention to an announcement that is being sent out by the Forsyth Dental Infirmary for Children which states that, beginning October 17, the Forsyth Dental Infirmary for Children, Boston, Massachusetts, will conduct a training school for dental hygienists. The circular or announcement states that the candidate must be eighteen years of age and must present a certificate of graduation from an approved high school or an equivalent of four years of high school study. The course of study covers a period of twelve months, the clinical hours being from 9 A.M. to 5 P.M. The courses of lectures and demonstrations given outside of these hours embodies the following subjects: orthodontia, histology, anatomy, physiology, bacteriology, oral bacteriology, laryngology, roentgenology, investing tissues of the teeth, contagious, infectious, and communicable diseases, general and oral hygiene, instrument and technic work, operative technic, clinical dentistry, clinical prophylaxis, oral pathology, sterilization and asepsis, dental pathology, teaching oral hygiene to children, oral surgery, extraction, novocaine anesthesia, dental jurisprudence, therapeutics, prosthetic prophylaxis, dental materia medica, general organic chemistry, orthopedics and neurology. Truly a wonderful array of subjects, and if anyone can inform us how a living individual in twelve months can master the subjects outlined there, working from 9 till 5, we are willing to admit they are superhuman. A twelve months course for dental nurses is better than a course of four and a half months, but we recognize the impossibility of teaching in twelve months even a rudimentary knowledge of all the subjects outlined in the announcement sent out by the Forsyth Dental Infirmary for Children.

We realize it is going to be a valuable thing for the Forsyth Dental Infirmary for Children if they can impress upon a number of girls who have the preliminary education which they require to spend 12 months in the supposition that they can learn everything in regard to the subjects mentioned in the announcement; but we ask whether it is fair to the students.

The subjects outlined in the announcement of the Forsyth Dental Infirmary for Children and the training school of dental hygienists are enough subjects and are practically the same subjects as are covered in a dental college. We have the same criticism to offer of this course that we made of the work on "mouth hygiene." It is absolutely impossible in a course of twelve months to give even a preliminary understanding of the subjects outlined in this announcement, even if the subjects are published to give a wonderful array of the ground covered and produce a wonderful effect on prospective students, and then insufficiently taught. Anyone who has had any experience in dental college work knows that the subjects of histology, anatomy and physiology can not even be approached in one year. Then of all the various other subjects outlined it shows that the course for "dental hygienists" is going to be very superficial and consequently of very little value. The clinical hours which are spent in the Forsyth Dental Infirmary from 9 A.M. to 5 P.M. will be more or less valuable training to

the "hygienist." When we consider the course of lectures and demonstrations to be given outside of these hours, embodying the above mentioned subjects, we can only say that the course for "dental hygienists" or dental nurses requires a whole lot of construction and thought before it will be of much value.

That these subjects are going to be thoroughly taught is proved by the announcement which says that the facilities of the various clinical laboratories in the Infirmary are made available and all of the pupils will receive thorough and comprehensive training to fit them to be teachers in public schools and institutions, and operative dental hygienists in the prophylactic treatment of teeth, and dental nurses in private offices and institutions. They will become thoroughly familiar with the theory of dental practice, sterilization, and administration of anesthetics, and prepare patients before, during, and after administration, also in operative procedures from a surgical standpoint. If the Forsyth Dental Infirmary completes all these things in a ***thorough*** and ***comprehensive*** manner in a period of twelve months, there is absolutely no use of a dental college spending four years in teaching a dental student. If the Forsyth Dental Infirmary can teach hygienists all of this knowledge in twelve months, dental colleges may just as well close their doors and admit they are absolute failures when it takes them four years to teach their students the same subjects.

However, this difference between twelve months and four years may be one of personal equation in that women are able to learn dentistry in twelve months while it takes the dental student four years to learn the same subjects. We are willing to admit there is a place for dental nurses, that there should be some place where they should receive proper instruction and the dental profession has a need for them. We are not wililng to admit that they should be given the high sounding name "dental hygienist" and be turned out as being thoroughly competent as a "prophylactic operator." We believe a successful prophylactic operator should have all the knowledge a dentist possesses and some more besides.. We believe that a successful prophylactic operator should have a thorough course of education in a dental college and we do not believe that he can receive that course of instruction in four and a half months, nor do we believe he can receive it in twelve months, whether the course is given in Bridgeport or Boston. However, we do believe that a prophylactic operator can attain a certain amount of proficiency if he has taken a complete course of instruction in a dental college and then spends four and a half months or twelve months in acquiring a further knowledge upon that particular subject.

We believe that a dental student who has graduated from a dental college can acquire a knowledge of anesthesia and the use of novocaine, or oral surgery by taking a course of six or eight weeks after he has taken a dental course. We also believe that a working knowledge of roentgenology or radiography can be obtained by a dental student after he has spent three or four years in dental college and then devotes three or four weeks to that particular subject; but we do not believe that a girl or anyone with an approved high school education can spend a year and master the subjects as outlined for dental hygienists by these various schools in any manner that is going to be satisfactory whatsoever. If we are going to have dental nurses we should have a course of instruction which will make dental nurses out of them and not try to make dentists out of them.

Furthermore, let the dental nurse have a course which will be sufficiently thorough and complete along the lines which a nurse is supposed to follow so that she will have a standing equal to the medical nurse and not try to make her something else by calling her a "dental hygienist" or a prophylactic operator because we have too much respect for prophylactic operators and too much respect for prophylactic treatment of teeth to believe it is possible for any institution to make a satisfactory prophylactic operator out of one who has no knowledge of dentistry in four and a half months or even twelve months.

Being familiar with postgraduate work and college work, we caution the dental profession not to let their enthusiasm run wild, along with the warning issued by the *British Journal of Dental Science* that we want to be careful in safeguarding the profession against the encouragement of an irregular practitioner donated with a high sounding title. It seems very illogical to us while attempts are being made to raise the standard of the dental profession and the course in the dental college has been lengthened from three to four years, that institutions and schools for dental hygienists should continue to announce that a thorough and comprehensive training can be given in all the subjects which are cited in this editorial in the course of twelve months. As a result of this we are forced to pause and wonder whether the legalizing of dental nurses under the present plan has been a step forward or a step backward in the proficiency and standard of the dental profession.

The Section on Stomatology of the American Medical Association

IN the *Journal of the American Medical Association,* June 16, 1917, which contains the minutes of the meeting of the American Medical Association held in New York City we notice several facts which are of interest to the dental profession, whether they are members of the Section on Stomatology or not. We do not exactly know how long the Section on Stomatology has been a definite part of the American Medical Association, but we believe the importance of that section has not been appreciated by the dental profession to the extent that it should be.

The registration at the New York session showed the Section on Stomatology with the smallest attendance except one. Forty-seven were enrolled as attending the Section on Stomatology. Considering the nature and interest of the program which was arranged by that section, and considering the center of population in which the meeting was held, we are forced to state that the membership of the Section on Stomatology was not what it should have been. However, it is probable that the Section has tried to obtain quality rather than quantity. In this respect the Section is to be congratulated, because so far as we know, it is the only dental society, or society pertaining to dentistry, in which the membership is to any extent limited. The limitation of membership is the result of a resolution introduced by Dr. William C. Fisher, of New York, which was carried. The resolution is as follows:

"To the House of Delegates: The following resolutions were passed by the

Section on Stomatology and were recommended to your body for favorable consideration:

"*Resolved,* That applicants for associate fellowship in the American Medical Association holding the degree of D.D.S., or its equivalent, and members of their local, county, or state dental organizations, before their application is approved by the section, must be considered by the executive committee of the section and must be endorsed by at least two members of this executive committee as having attained to a position in the dental profession, either by virtue of original research work done, or some meritorious service rendered to the profession or public which shall, in the judgment of these members of the executive committee of the section, warrant favorable action on the application."

These resolutions were read by the Secretary of the House of Delegates and the House of Delegates approved the action of the Section on Stomatology. We believe this is a wise plan, and we believe it would be a wise plan if more dental societies limited their membership upon the ability of the men joining the Society as having done original research work or performed some meritorious service to the profession or public. In the majority of societies the applicant for membership does not receive the proper consideration which he should receive and a great many men are becoming members of societies whose membership does not improve the society to any extent. However, we are told in local and state dental societies, and the same is more or less true, that the society is for the benefit of the individual and the individual is not supposed to necessarily be a benefit to the society.

It is perfectly well and proper that a certain number of dental societies should to a certain extent do missionary work and try to improve the dental profession by elevating some of the members of the profession, but we also realize that if we are to elevate the profession, we must have a few societies, so planned that in order to obtain membership in that society the man must show more than extraordinary ability in meritorious work or perform original research. We, therefore, believe that the resolution adopted by the House of Delegates approving the action of the Section on Stomatology is a very good plan, and we hope to see the same plan followed in other societies in the near future.

We have often been impressed with the fact that the medical profession did not have the proper understanding or appreciation of stomatology and we have thought recently that the medical profession was realizing the importance of dentistry; but in reading the minutes of the House of Delegates of the New York session, we are impressed with the fact that the general medical profession, as a whole, do not even yet appreciate the importance of dentistry or stomatology. This is proved by the fact that, in arranging the sessions of the scientific assembly in which each section is grouped according to units allowed, we find the Committee on Rules recommended that the Section on Stomatology be allowed only two units, but one other section being allowed so small a number of units.

The fact that dermatology, ophthalmology, laryngology, otology, and rhinology are allowed six units and stomatology only two, clearly indicates that the importance of stomatology is not yet recognized by the medical profession.

We certainly believe that stomatology has a greater importance in the welfare of the human race than does ophthalmology. We recognize the importance of the eyes, but we also recognize the fact that the eyes are more a question of luxury, as some of the animal kingdom live without eyes, but none without teeth, or their equivalent. However, we are pleased to note that through his efforts as delegate from the Section on Stomatology, he was able to amend by substituting three units for two units in reference to the Section on Stomatology. However, we believe at the present time that stomatology has practically 50 per cent of the importance paid to it by the medical profession that it is entitled to according to the ratings of other sections.

There is no use in making objections unless the dental profession, as a whole, recognize the Section on Stomatology as being associated with the American Medical Association, and by working through that Section we believe the dental profession will be able to obtain an earlier recognition from the medical profession than it will by finding fault and doing nothing. We, therefore, recommend that every dentist who is interested in the advancement of dentistry as a profession and in obtaining recognition from the medical profession which we have talked so much about shall perfect himself so that he will be eligible for membership in the Section on Stomatology; and by concerted effort we may be able to impress upon the medical profession that stomatology is just as important to the human race as ophthalmology, laryngology, otology, and rhinology.

The Internal Anatomy of the Face*

SEVERAL years ago when the first edition of Cryer's "Internal Anatomy of the Face" made its appearance there had never been a book written which contributed so much towards the study of the anatomy of the face as did Dr. Cryer's work. We now have the second edition of this valuable contribution to anatomy which is much larger than the first and which contains many more valuable illustrations. Chapter I is an introduction to the study of the anatomy of the face, and Chapter II deals with general considerations.

Chapter III is devoted to the mandible and contains many valuable suggestions and facts which are very often overlooked. The various shapes of the mandible as found in different cases of the individual are shown,—anatomical facts which must be recognized. However, it must be remembered that the changes which occur in the mandible and have been pointed to as the result of age, are produced more or less by the result of use. If it were possible for a person to maintain all of the natural teeth in normal occlusion, there would be very little change in the shape of the mandible from the time the permanent teeth erupted until the time the individual passed away at an advanced age. The greatest factors in the change of the mandible, which have been attributed to age, are the result of use brought about by changing occlusion.

*The Internal Anatomy of the Face. By M. H. Cryer, M.D., D.D.S., Professor of Oral Surgery, University of Pennsylvania; Oral Surgeon to the Philadelphia General Hospital. 360 pages, 377 illustrations. Second edition. Published by Lea & Febiger, Philadelphia and New York.

The different shaped mandibles found in different races are also referred to, which is a very important point; also different shapes in the angle and the body of the mandible are important factors. These changes are also very often the result of disease or disuse which is a factor that has often been overlooked. A study of the mandibular articulation is also taken up,—another subject that has not received the attention it deserves. It must also be remembered that the changes, occurring in the temporo-mandibular articulation, are the result of the use and occlusion of the teeth, which fact Dr. Cryer clearly demonstrates by showing a number of temporo-mandibular articulations taken from lower animals.

The work contains a very complete study of the maxilla, with a number of cuts showing the cross sections in the nasal and oral cavity with reference to maxillary sinuses and other sinuses of the face.

Chapter V is a consideration of the mouth, including the teeth, in which there are several good features and also the use of some terms which are more or less questionable. For instance, in speaking of the alveolar process the statement is made that the upper portion of the alveolar border is covered by gum tissue. We think it would be less confusing and more descriptive if the word upper and lower in describing positions on teeth would be dropped and the term apical and gingival be used in their place. It would be more descriptive to say that the gingival portion of the alveolar process is covered by gum tissue and it would be less confusing to the student than the use of the word upper which would be all right in the mandibular teeth, but would not be exactly correct on the maxillary teeth.

In the description of the human teeth we are glad to note that Dr. Cryer has used the more scientific term in describing the teeth under the name of maxillary and mandibular rather than upper and lower. We realize that it will be quite a task to convince the dental profession that the terms maxillary and mandibular teeth are more scientific and descriptive than the terms upper and lower teeth. We are also pleased to note the use of the term canine and premolar in preference to the much overworked term cuspid and bicuspid. In the description of the molars we notice that the term morsal is used where the word occlusal would be more fitting. We believe it is questionable whether a description of the teeth such as is given by Dr. Cryer in the "Internal Anatomy of the Face" should be given. While it is very good and correct, it also lacks very much in detail. In other words, it is a question whether a work on the anatomy of the face should also include a short description of the teeth. We believe that it would be much better if in the future textbooks would be confined to one particular phase of the subject and works on internal anatomy of the face be confined to the internal anatomy of the face and works on dental anatomy be of such a nature as to give a detailed and full description of the teeth themselves, including every phase of the subject as expected to be taught in dental anatomy.

The book, as a whole, is a very valuable contribution to dental literature; the illustrations are above the average, and it is a textbook that should be in the library of every man interested in the science of dentistry.

Mouth Hygiene*

A FEW months ago there came to our office a very beautifully bound and printed book of the above title, containing a number of illustrations. In going over the table of contents it appears that the author of the book has attempted to cover every phase in the field of dentistry, and consequently in order to do this, each subject is more or less partially treated. At first glance it would seem that the authors have the desire to cover the entire dental field, thus necessitating the use of only one textbook. This would be a very great advantage to the average dental student, for we realize that the majority of dental students today are opposed to buying textbooks. If the publishers of this textbook have succeeded in getting all the necessary knowledge under one cover, in so doing they have performed a very great service to the dental student.

However, in studying the preface we find that the book is intended to contain the fundamentals necessary for prophylactic operators, but even with this point in view we very much question the wisdom of attempting to give prophylactic operators an education which covers such a wide field as is outlined in the work on mouth hygiene and the superficial manner in which each subject must necessarily be treated.

The first chapter, written by Raymond C. Osburn, Ph.D., on anatomy, contains 56 pages and covers the entire field of anatomy, including histology, the study of the cells, the nutritive system, the alimentary canal, the respiratory system, the circulatory system, the ductless glands, the skeleton, the muscle and the nervous system. It is our belief that it is absolutely impossible to cover the field of general anatomy in 54 pages in such a manner as to give the prophylactic operator even a hazy idea of the subject. We do not believe it is possible to describe the anatomy of the mouth in that many pages, hence to cover the entire anatomic field is impossible.

The second chapter dealing with special anatomy which is edited by Robert H. W. Strang, M.D., D.D.S., deals with the various parts of the cranium and the skull, the maxillary sinuses, takes up a description of the eyes, of the ears, the maxilla and the mandible, a description of the oral cavity, of the cranial nerves, the intermaxillary arteries, the tonsils, and teeth. He also goes into the histologic structure of the teeth and this chapter, like a former chapter, covers entirely too much ground in a superficial manner. Likewise the question of physiology is taken up in Chapter III and we believe that the chapter as treated, unless read by one who is more or less familiar with the subject of physiology, would simply tend to be confusing because the subject is very much abbreviated and described in such a brief manner. The same may be said to be true of bacteriology and the other subjects which are mentioned. We realize that oral prophylaxis specialists must have a knowledge of these subjects. We are also aware of the fact that a little knowledge is a dangerous thing, and only a little knowledge can be crowded into a book of this nature. The subject of inflammation and dental caries is also treated, and illustrations are taken from standard works by other men. But again, the description is too brief to be of any practical nature.

*Mouth Hygiene. Compiled by Alfred C. Fones, D.D.S., Bridgeport, Conn. 530 pages, 278 illustrations, 7 color plates. Published by Lea & Febiger, Philadelphia and New York, 1916.

We find Chapter VIII dealing with the teeth as a masticating machine. This is a very important chapter. It deals with comparative dental anatomy and contains a very large number of illustrations. But you will now remember that the dental hygienist has thrust upon him a chapter dealing with comparative dental anatomy in a very brief manner. However, that portion of the chapter dealing with the mechanism of mastication is very good and very ably written by Dr. Turner.

Chapter IX deals with odontalgia and alveolar abscess, and is written by R. Ottolengui, M.D., D.D.S., LL.D. Here again we have in one chapter the entire subject of orthodontia, which includes a study of normal occlusion, a definition of occlusion, classification of malocclusion according to the Angle classification, etiology of malocclusion, the growth of jaws, reasons for lack of use, and so forth. In other words, in one short chapter the entire subject of orthodontia is outlined. We believe that the dental hygienist's knowledge of malocclusion should be more than is contained in Chapter IX, because the manner in which the chapter is written, containing only a brief amount of information, is more confusing than of practical value. Likewise the question of pyorrhea alveolaris, written by R. G. Hutchinson, Jr., D.D.S., offers the same criticism that is found in the others. However, in this case the chapter is more brief, containing only 6 pages and each page very limited in treatment.

Chapter XI deals with odontaglia and alveolar abscess, and is written by M. L. Rhein, M.D., D.D.S., D.R.C., U.S.N. According to our understanding, the work of the dental hygienist is not the treatment of alveolar abscesses. Therefore, why this chapter should be included in the book which is supposed to be for the use of dental hygienists is beyond our understanding.

Chapter XII, which takes up dental prophylaxis, written by Albert C. Fones, D.D.S., begins with the study of the cell. We have considerable difficulty in associating the life history of the cell with what we understand as dental prophylaxis. We believe that the cell is too important a subject to serve as an introduction to the chapter on dental prophylaxis. The cell, in order to be studied, should be treated only in a complete manner and not as an introduction to another chapter.

The phase which deals with practical work of oral prophylaxis is very good, and we believe the book would have filled a much greater need had the author confined the book to the subject of mouth hygiene, and not tried to make it an encyclopedia of dentistry, covering the entire dental field. The book even has a chapter on dermatology and syphilis, which are very important medical subjects, also a chapter on the factors in personal hygiene which is of value but our objection to the book as we first stated is the fact that it covers entirely too large a field and consequently each subject is covered more or less briefly and in such a manner as to be confusing to one who has no knowledge of the subject. The entire dental field is too large to be thoroughly covered in one book. Our criticism would be then that the book should have been limited to the title, namely, "Mouth Hygiene," and should not have been made a work on general anatomy, comparative anatomy, histology, bacteriology, pathology, and comparative dental anatomy. In all of our experience we have never seen a book with

so nice a title, nor have we ever found a book in which the authors have made so many attempts to stay away from the subject as is found in this.

This book can be recommended to one who is desirous of getting a smattering of the subject of dentistry by reading only one volume. It reminds us of the day when dentistry had but one textbook which was Harris' "Practice of Dentistry," and one book was considered sufficient for all purposes.

Books on Histology

"TEXT BOOK OF HISTOLOGY," by Rudolph Krause, Professor of Anatomy at the University of Berlin; translated from an original manuscript, printed only in the English language, with thirty-six illustrations. The reference to the illustrations, given in the text, relate to the colored illustrations published in Dr. Krause's "A Course in Normal Histology." The textbook is used in conjunction with "A Course in Normal Histology" which is published in two volumes. The first volume is a guide for "Practical Instructions in Histology and Microscopic Anatomy," translated from the German by Philip J. R. Small, of New York. Published by Rebman Company, New York.

Volume I deals with the technic of the microscope, and the preparation, staining, and cutting of the specimen. The construction of the different parts of the microscope, as explained, will give the student some idea of the work of the instrument. Part one consists of 30 illustrations, covering the subjects above mentioned.

The second volume of the course contains 208 colored pictures, arranged on 98 plates, after the original drawings by the author. It consists of 406 plates of text, which is given over exclusively to the description of the illustrations, to be used in conjunction with the "Text Book of Histology," which describes the organs illustrated entirely from the histologic standpoint, and does not deal so much with the specimen. The illustrations referred to in the "Text Book of Histology" are those appearing in "A Course in Normal Histology." Therefore, it is necessary, in order to get the greatest amount of good out of these works, to have the three volumes, which will give a much better understanding of the subject than can be obtained from any single work on histology with which we are familiar. The work is specially recommended to the practitioners interested in histologic studies, and who desire more information upon the subject than can be obtained in the usual work on histology, which very often has been prepared from the student's standpoint rather than from the standpoint of the general practitioner. The subjects are so indexed and headed that they can be easily followed, and so worked out that the subjects blend together very well. The work begins with the study of the cells, then the study of the tissues, and then the study of the individual organ, which is the proper basis and plan for the study of histology. We hope that these works will receive the recognition which they merit.

Crown and Bridge Work for Students and Practitioners*

DR. PEESO'S work on Crown and Bridge Work fills a long felt want in the dental profession, for he has been a recognized authority on certain phases of bridge work. The book as a contribution to dental literature is very valuable. It is especially interesting to orthodontists, due to the fact that it is one of the few volumes on crown and bridge work that lays particular stress on the occlusion of the teeth. We believe Dr. Peeso is among the first men to publish a textbook on this subject recognizing the basic principles of occlusion as being necessary to perfection and success in crown and bridge work.

For a number of years the majority of works that were written, dealing with crowns and bridges, dealt with particular technical phases of the subject, and their plan seemed to be the construction of the crown and bridge regardless of the service to be rendered in after years. Dr. Peeso's work considers the primarily important factor in the construction of the crown and bridge the making of one which will render physiologic service due to its construction along anatomic lines; and in order for this to be possible, occlusion must be considered one of the necessary features. The introduction to the work reads as if it had been written by a man who was an orthodontist rather than one who has given his time to crowns and bridges. But if we pause and consider, we realize that the basic principle of occlusion has as great a bearing on the construction of crowns and bridges as it does on the correction of malocclusion. We, therefore, realize that it is a great step forward which Dr. Peeso has taken in recognizing occlusion as the basic principle.

To those who are interested in the phases of crown and bridge work we heartily recommend this work, for we are convinced that a man who has such a thorough understanding and respect for occlusion of the teeth, which is necessary to construct a better crown and bridge, can write a better book than one who does not recognize these principles.

*Crown and Bridge Work for Students and Practitioners. By Frederick A. Peeso, D.D.S., Director of the Dental Graduate Schools of the University of Pennsylvania. 752 illustrations. Published by Lea & Febiger, Philadelphia and New York, 1916.

The International Journal of Orthodontia

Editor: Martin Dewey, D.D.S., M.D.

VOL. III ST. LOUIS, OCTOBER, 1917 NO. 10

ORIGINAL ARTICLES

THE DEVELOPMENT OF THE BONES OF THE FACE*

BY WARREN B. DAVIS, M.D., PHILADELPHIA, PA.

Oral Surgeon to Philadelphia General Hospital; Assistant Demonstrator of Anatomy, Jefferson Medical College.

STATEMENTS in this paper regarding development earlier than that found at the sixtieth day of embryonic life are brief summaries expressing the consensus of opinions held by the majority of embryologic observers. Statements regarding development later than the sixtieth day of embryonic life are based chiefly upon the study of my own sections and dissections of a series of one hundred and forty-five specimens covering the periods of development from the sixty-day fetus to adult life. In addition to the facial bones proper, the frontal, ethmoid and sphenoid bones will be considered because of their close relations to the facial area.

At the end of the second week of intrauterine life, human embryos show the first appearance of the primordial cranium in the mesenchyme investing the anterior portion of the notochord. From this there is an extension dorsally to inclose the anterior portion of the medullary canal, which will later become the cerebral portion of the central nervous system. From that part of the primordial cranium which extends forward beyond the anterior portion of the notochord, a core is formed for the frontonasal process—a relatively broad mass of tissue which later separates the nasal pits. Beginning development of the nasal area is shown, during the third week of embryonic life, by increasing thickness of the ectoderm on the anterolateral portions of the forebrain. During the fourth week, the increasing thickness of the surrounding mesenchyme causes the nasal areas to appear as symmetric depressions or nasal pits, which are at first pyriform in outline, with the small ends toward the primitive mouth cavity (Fig. 1).

*Read before the American Society of Orthodontists at its sixteenth annual meeting, Pittsburgh, Pa., July 21, 1916.

In the early stages of development the nasal and oral fossæ form one cavity. The superior boundary is formed by the median frontonasal process, on each lateral portion of which is the processus globularis. Laterally, the boundaries develop from the first visceral or branchial arches, which grow ventrally until they meet in the median line, and thus come to also form the inferior

Fig. 1.—Head of twenty-eight day embryo. (His.)

Fig. 2.—Diagram drawn from a coronal section through nasal area of a sixty-day embryo. (Series A, No. 1, slide 6, section 6. $\times 16\frac{2}{3}$.)

Sept.na., Septum nasi, note relative thickness at this stage of development; *C.inf.*, concha inferior; *Proc.pal.*, processus palatinus of maxilla, *Org.vom.*, organon vomeronasale (Jacobsoni); *Cart.cap.na.*, cartilago capsulæ nasalis.

boundary. The lower portions of the first visceral arches are converted into the mandible and the soft tissues investing it, while from the upper portions the maxillary processes grow anterosuperiorly, and from them the portion of the face between the mouth and the orbits is developed, and in it the maxillæ, malar,

Note.—Figs. 2-8 and 12-29 are taken from Davis: "Nasal Accessory Sinuses," by courtesy of W. B. Saunders Co.

and palate bones, and probably the internal pterygoid plates are developed and ossified.

As the processus globularis and the lateral nasal and maxillary processes approximate, their ectodermal coverings are brought into contact. The intervening ectoderm is then resorbed and the processes become united by mesoderm, thus forming the floor of the primitive nares. The broad median process separating the nasal depressions later becomes narrowed and forms the septum nasi.

The palatal ridges appear on the medial sides of the maxillary processes from the forty-fifth to forty-eighth day of embryonic life (J. P. Schaeffer), and by their approximation the anterior portion of the palate is formed, fusing an-

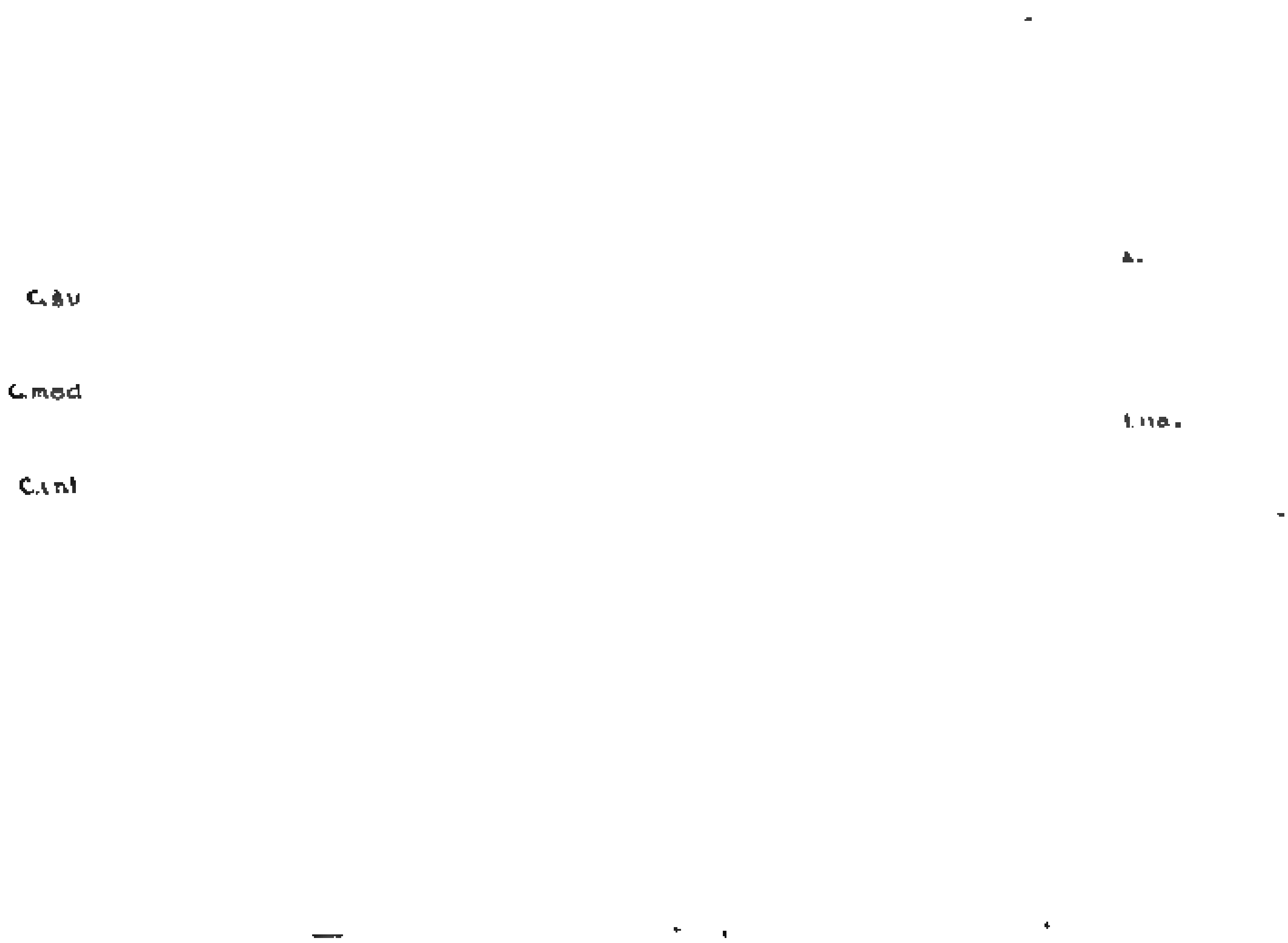


Fig. 3.—Diagram of coronal section through nasal area of a sixty-five-day embryo. (Series A, No. 3, slide 7, section 3. × 16.)

Cart.cap.na., Cartilago capsulæ nasalis; *Sept.na.*, septum nasi; *C.inf.*, concha inferior; *C.med.*, concha media; *C.sup.*, concha superior. Note ossification centers of the vomer.

teriorly with the premaxillary process and behind this with each other (Fig. 2). Fusion has usually taken place between the maxillary and globular processes during the eighth week, between the palatal ledges of the maxillary processes about the tenth week, and between the horizontal portions of the palate bones about the eleventh or twelfth week. Failure in this fusion results in cleft palate, or harelip and cleft palate, the clinical variety of the cleft depending upon the extent of nonfusion between these processes.

The basal part of the primordial craninum develops into chondrocranium. Laterally, the basal plates develop as the periotic capsules, ventrally they form the mesethmoid plate, and anterolaterally they enter into the formation of the nasal capsule, which in the second month shows distinct cartilaginous

Fig. 4.—Diagram of coronal section through the anterior third of the nasal area of a ninety-five-day embryo, to show the extent of development and relations of the processus uncinatus and the bulla ethmoidalis. (Series A, No. 6, slide 11, section 6. × 10.)

Cr.gal., Crista galli; *B.eth.*, bulla ethmoidalis; *Proc unc.*, processus uncinatus; *Infund.eth.*, infundibulum ethmoidale; *C.inf.*, concha inferior; *C.med.*, concha media; *Sept.na.*, septum nasi.

Fig. 5.—Diagram drawn from a coronal section near the midpoint anteroposteriorly of the lateral nasal wall. (Series A, No. 12 (one-hundred-and-twenty-one-day fetus), slide 8, section 1. × 6.)

B.eth., Bulla ethmoidalis; *C.med.*, concha media; *Proc.unc.*, processus uncinatus; *C.inf.*, concha inferior; *Infund.eth.*, infundibulum ethmoidale; *Sept.na.*, septum nasi.

development (Fig. 2). The chondrocranium reaches its highest relative development in the third month of intrauterine life. Most of the bones of the base of the skull are first formed of the cartilage and the cartilage is later replaced by bone (substitution bone). On the other hand most of the bones of the face and the flat bones of the skull are formed directly in membranous tissue (intra-

membranous bone). Some of the bones are partly membranous and partly cartilaginous in origin.

Ossification begins during the second month of intrauterine life. Mall (1906) has found centers of ossification for the mandible (thirty-ninth day), maxilla (thirty-ninth day) and premaxilla (forty-second day), before any center of ossification has appeared in the chondrocranium. The first centers of ossification to appear in the chondrocranium are those in the occipitale laterale (fifty-sixth day), the basioccipital (sixty-fifth day), orbitosphenoid (eighty-third day) and basisphenoid (eighty-third day). The chondrocranium is largely but not completely replaced by bone. The cartilages of the septum and alæ of the nose represent remnants of the chondrocranium.

Ossification centers appear in the mesenchyme of the facial area to form the nasal, lacrymal and malar bones. The center for each nasal bone appears, at the end of the second month, on the surface of the cartilaginous nasal capsule, the underlying cartilage being absorbed early in postnatal development

Fig. 6.—Diagram drawn from a horizontal section just above the anterior attachment of the concha superior. (Series A, No. 13 (one-hundred-and-twenty-six-day fetus), slide 10, section 1. × 3.)

Specimen shows the processes of pneumatization developing superiorly into the lateral masses of the ethmoid, thus forming the primitive cellulæ ethmoidales. *Sept na.*, Septum nasi; *Infund.eth.*, infundibulum ethmoidale; *Cel eth ant.*, cellulæ ethmoidales anterior; *Cel.eth post.*, cellulæ ethmoidales posterior; *Ep.*, epithelial invagination from meatus superior.

(Bardeen). The malar bone appears as a three-cornered center about the sixty-fifth day (Mall), becoming four-cornered a few days later. These corners form the two orbital, the maxillary, and the temporal processes of the bone as it assumes its more definite form. In the third month (eighty-third day) (Mall), a center for the lacrymal bone appears on the posterior part of the cartilaginous capsule of the external nose.

In studying the development of the facial bones arising from the first branchial arch, it is found that a cartilaginous bar develops only in the dorsal portion of the maxillary process. The cartilage becomes invested and gradually replaced by membrane bone which eventually fuses with the sphenoid bone, forming its internal pterygoid plate (Bardeen). In the more ventral portions of the maxillary process, two membrane bones, the palatine and the maxilla, are developed. The palatine has a single center of ossification appearing in

Fig. 7.—Sagittal section ¼ mm. to the right of median line anteriorly and 1¼ mm. to right of median line posteriorly through the body of the sphenoid. (Fetus one hundred and thirty-five days old. Series B, No. 1. × 1⅓.)

Shows the lateral nasal wall and the developing sinus sphenoidalis which extends into the remnant of the posterior portion of the cartilaginous nasal capsule. The concha sphenoidalis (ossiculum Bertini) develops in that portion of the cartilage which forms the antero-inferior boundary of the primitive sinus sphenoidalis. *Cap.nas.post.*, Capsula nasalis posterior; *Hypoph.*, hypophysis; *Ost.tub.aud.*, ostium tubæ auditivæ; *Vest.na.*, vestibulum nasi; *C.inf.*, concha inferior; *Lob.*, lobulus; *Ag.na.*, agger nasi; *C.med.*, concha media; *C.sup.*, concha superior; *C.supr.I.*, concha suprema I; *S.sph.*, sinus sphenoidalis.

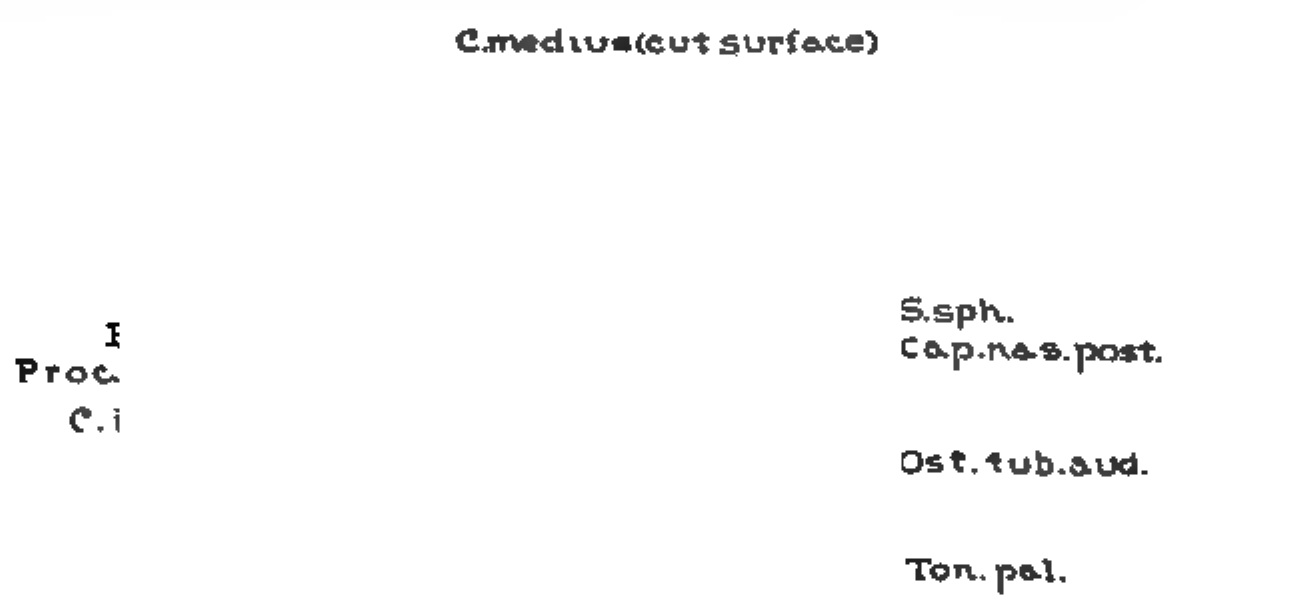


Fig. 8.—Sagittal section, median anteriorly, posteriorly 1¼ mm. to the right of median line. (Fetus one hundred and eighty-eight days old. Series B, No. 4.)

The greater portion of the concha media has been removed in order to show the relations of the recessus conchalis, processus uncinatus, hiatus semilunaris, and bulla ethmoidalis. This specimen shows the presence of five conchæ ethmoidales, the only specimen in the entire series having so great a number. Note the extent of development of the sinus sphenoidalis. *C.med.*, Concha media (cut surface); *C.sup.*, concha superior, *C.supr.I*, concha suprema I, *C.supr.II*, concha suprema II; *C.supr.III*, concha suprema III; *S.sph.*, sinus sphenoidalis, *Cap.nas.post.*, Capsula nasalis posterior; *Ost.tub.aud.*, ostium tubæ auditivæ: *Ton.pal.*, tonsilla palatina; *C.inf.*, concha inferior; *Proc.unc.*, processus uncinatus; *B.eth.*, bulla ethmoidalis; *Ag.na.*, agger nasi

the eighth week (Mall) in the region corresponding to the angle between the horizontal and vertical parts. For each maxilla five centers of ossification are usually described—one giving rise to that portion of the alveolar region containing the molars and premolars, a second forms the nasal process and the part of the alveolar process containing the canine tooth, a third which contains the incisor teeth, and a fourth and fifth which lie above the first and give rise to the inner and outer portions of the orbital plate and the body of the bone (McMurrich). Mall (1906), however, describes only two centers—one for each of the distinct parts of the maxilla the premaxilla, or medial portion, and a lateral or maxilla proper. Both centers appear during the sixth week and usually become united by the early part of the third month.

The mandible is ossified in the membranous tissue lateral to Meckel's car-

Fig. 9.—The skull at birth. (From Morris' Human Anatomy.)

tilage. Its ossification center may appear as early as the thirty-ninth day. By the forty-second day the ramus and the alveolar process may be distinguished. By the fifty-fifth day the coronoid process and condyle are demonstrable, and by the eightieth day the mandible shows its characteristic shape (Bardeen). At birth the lower jaw usually consists of the two lateral parts united by fibrous tissue at the symphysis. Osseous union takes place during the first year.

The frontal—a membrane bone—develops from two centers, one on each side of the median line. The two portions fuse and form a single bone in early postnatal development, though indications of the median suture not infrequently persist.

The ethmoid develops from the chondrocranium and has three centers of ossification—one for each lateral mass and one extending from the crista galli into the median plate. The centers for the lateral masses develop first, appearing in the lateral wall of the nasal capsule in the fifth or sixth fetal month, giving rise

Fig. 10.—Adult skull. (From Sobotta-McMurrich Anatomy.)

Fig. 11.—Skull of a woman eighty-three years old, to show the changes in the mandible and maxilla. (From Morris' Human Anatomy.)

to the lamina papyracea. In the seventh and eighth months ossification extends into the conchae. Ossification of the vertical plate begins about the sixth postnatal month. Accessory nuclei appear in the lamina cribrosa during the second year and by the fourth or fifth year the lateral and medial parts are united. Ossification, however, is not complete until after puberty.

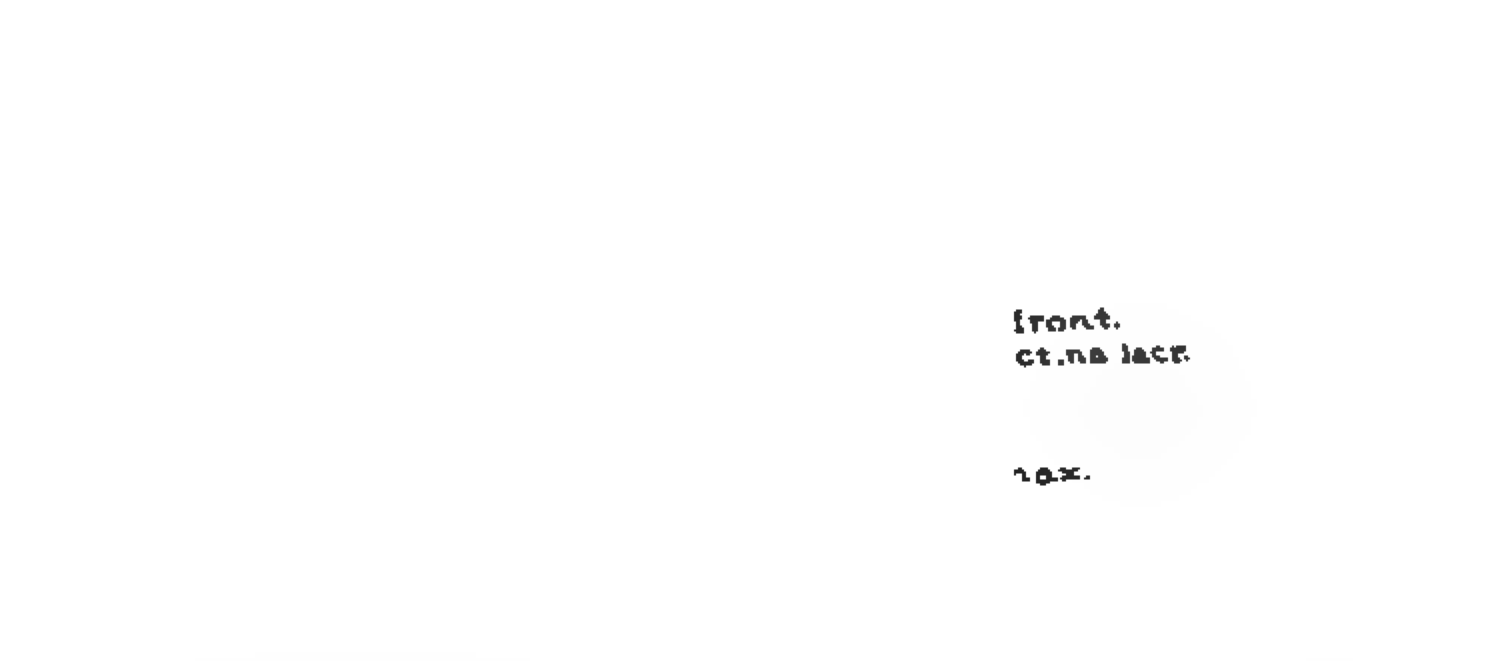


Fig. 12.—Specimen from a child eight days old (Series D, No. 1.)

By sagittal sections removing the lateral portion of frontal bone, lamina papyracea of ethmoid, and lateral portion of maxilla—the sinus maxillaris, cellulæ ethmoidales, anterior and posterior, infundibulum ethmoidale, and the primitive sinus frontalis are brought into view. *S.front.*, Primitive sinus frontalis; *Duct.na.lacr.*, ductus nasolacrimalis; *S.max.*, sinus maxillaris; *Cel.eth.post.*, cellulæ ethmoidales posterior; *Cel.eth.ant.*, cellulæ ethmoidales anterior; *Infund.eth.*, infundibulum ethmoidale.

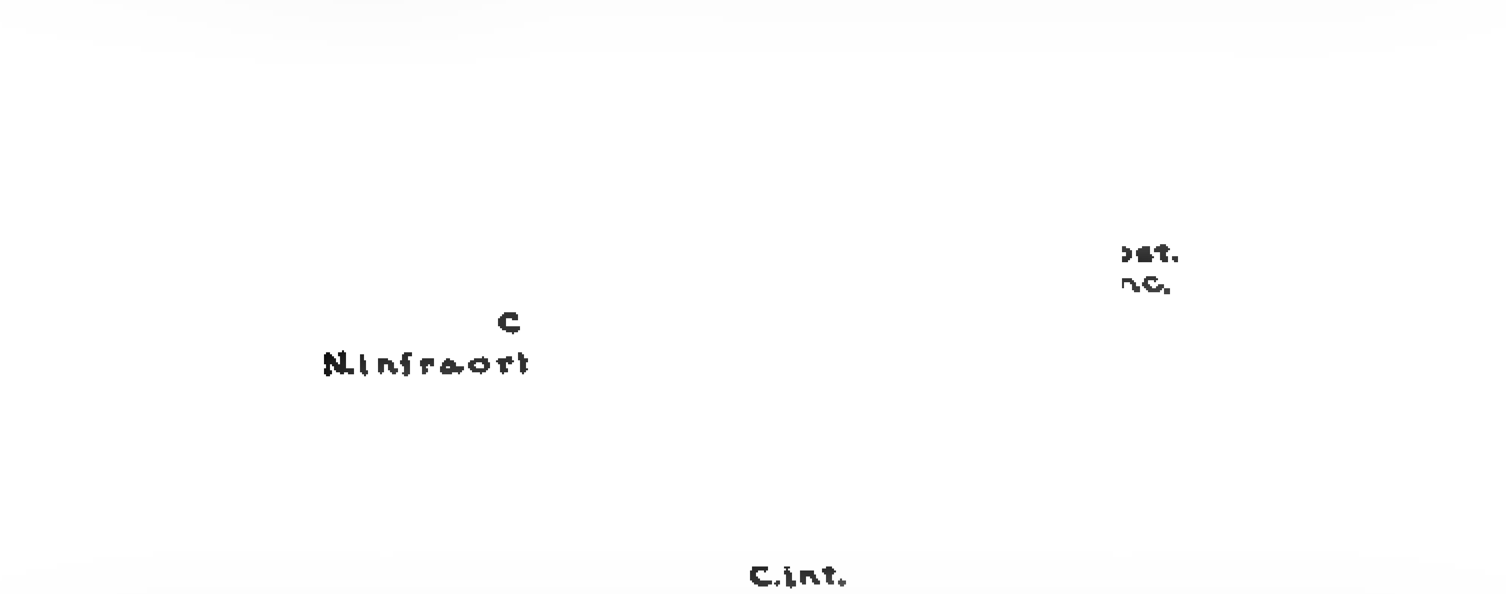


Fig. 13.—Specimen from a child one month and eight days old. (Series D, No. 2.)

Posterior view of coronal section cut 16 mm. posterior to the nasion, showing the extent of superoinferior and lateral development of sinus maxillaris and cellulæ ethmoidales posterior. Note the proximity of developing teeth to the orbital floor. *Cr.gal.*, Crista galli; *Cel.eth.post.*, cellulæ ethmoidales posterior; *Proc.unc.*, posterior extremity of processus uncinatus, *S.max.*, sinus maxillaris; *C.inf.*, concha inferior; *N.infraorb.*, nervus infraorbitalis; *C.med.*, concha media; *C.sup.*, concha superior.

The concha inferior arises from a separate center which appears during the fifth month in the cartilage forming the lower portion of the nasal capsule.

The vomer is a membrane bone arising from two ossification centers which develop in the mesenchyme on each side of the posterorinferior border of the mesethmoid cartilage (Fig. 3). Two vertical bone plates develop and become united beneath the inferior margin of the septum, while superiorly they embrace the lower border of the septal cartilage (Figs. 4 and 5). The posterior portion of the cartilage thus invested ossifies, part undergoes a certain amount of re-

sorption, while the anterior portion persists as the cartilaginous septum of the nose (Fig. 18). Union between the two plates of the vomer is completed about the age of puberty. The groove on the anterosuperior margin of the vomer remains for the attachment of the vertical plate of the ethmoid and the septal cartilage.

Fig. 14.—Specimen from a child one year, four months, and seven days old. Lateral view of frontal, ethmoidal, and maxillary sinus areas. (Series D, No. 14.)

S.front, Sinus frontalis developing from a frontal cell; *Infund.eth*, infundibulum ethmoidale; *Fos sac.lacr.*, fossa sacci lacrimalis; *Ost max.*, ostium maxillare; *N.abduc.*, nervus abducens, *A car.int*, arteria carotis interna; *Gang.semi*, ganglion semilunare (Gasseri), *N.troch*, nervus trochlearis; *N oculom*, nervus oculomotorius; *For.optic.*, foramen opticum; *Cel.eth.post*, cellulæ ethmoidales posterior; *Cel.eth.ant.*, cellulæ ethmoidales anterior.

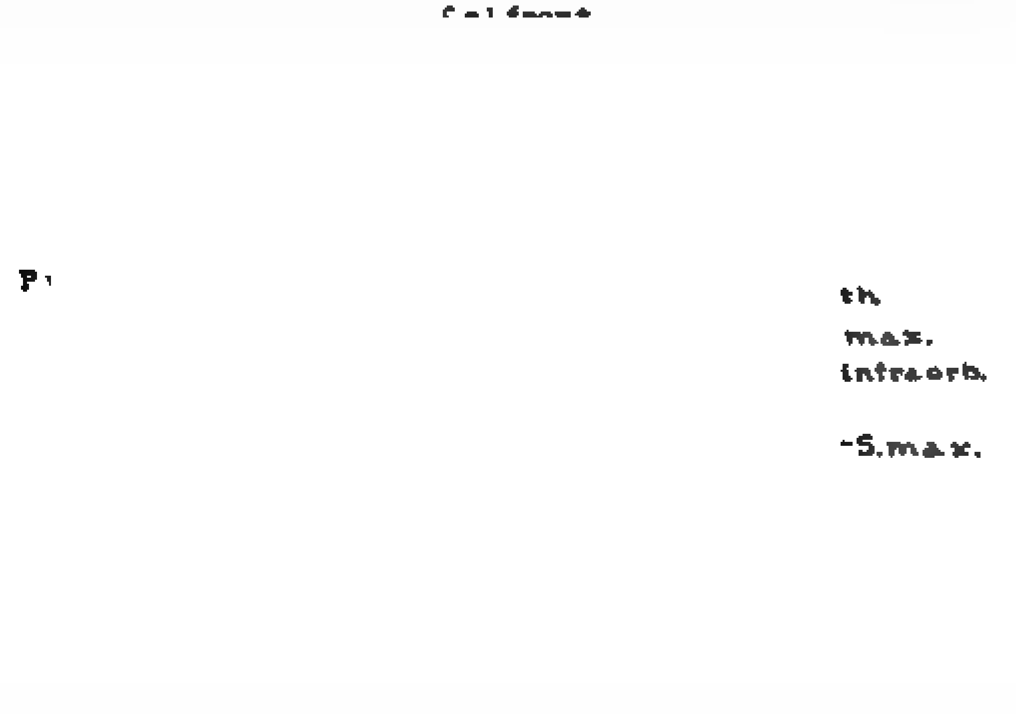


Fig. 15.—Specimen from a child four years, seven months, and nineteen days old. (Series D. No. 40.)

Anterior view of coronal section, cut 16 mm posterior to the nasion, showing the lateral and supero-inferior extent of the maxillary sinuses, their relations to developing teeth, and the relations of the ostium maxillare to the infundibulum ethmoidale. Note ridge beneath the right nervus infraorbitalis. The bullar cells have their ostia in the suprabullar furrow. The ostia of the cellulæ frontales are medial to the processus uncinatus and the bulla ethmoidalis. *Cel front*, Cellulæ frontales, *Cel b.eth.*, cellulæ bulla ethmoidales, *Infund eth.*, infundibulum ethmoidale; *Ost max.*, ostium maxillare; *N.infraorb.*, nervus infraorbitalis; *S. max.*, sinus maxillaris; *Proc unc*, processus uncinatus.

The sphenoid bone arises from 14 centers of ossification which appear during the second and third fetal months. The basal portion of the cartilage ossifies to form two bones—the presphenoid and the basisphenoid—on each side of which centers develop for the orbitosphenoids (lesser wings) and alisphenoids (greater wings). An additional center appears on each side of the basisphenoid to form the lingula—which unites with the basisphenoid during the third month. In the sixth month the orbitosphenoids unite with the presphenoid. In the seventh month the presphenoid and basisphenoid unite, while fusion of the ali-

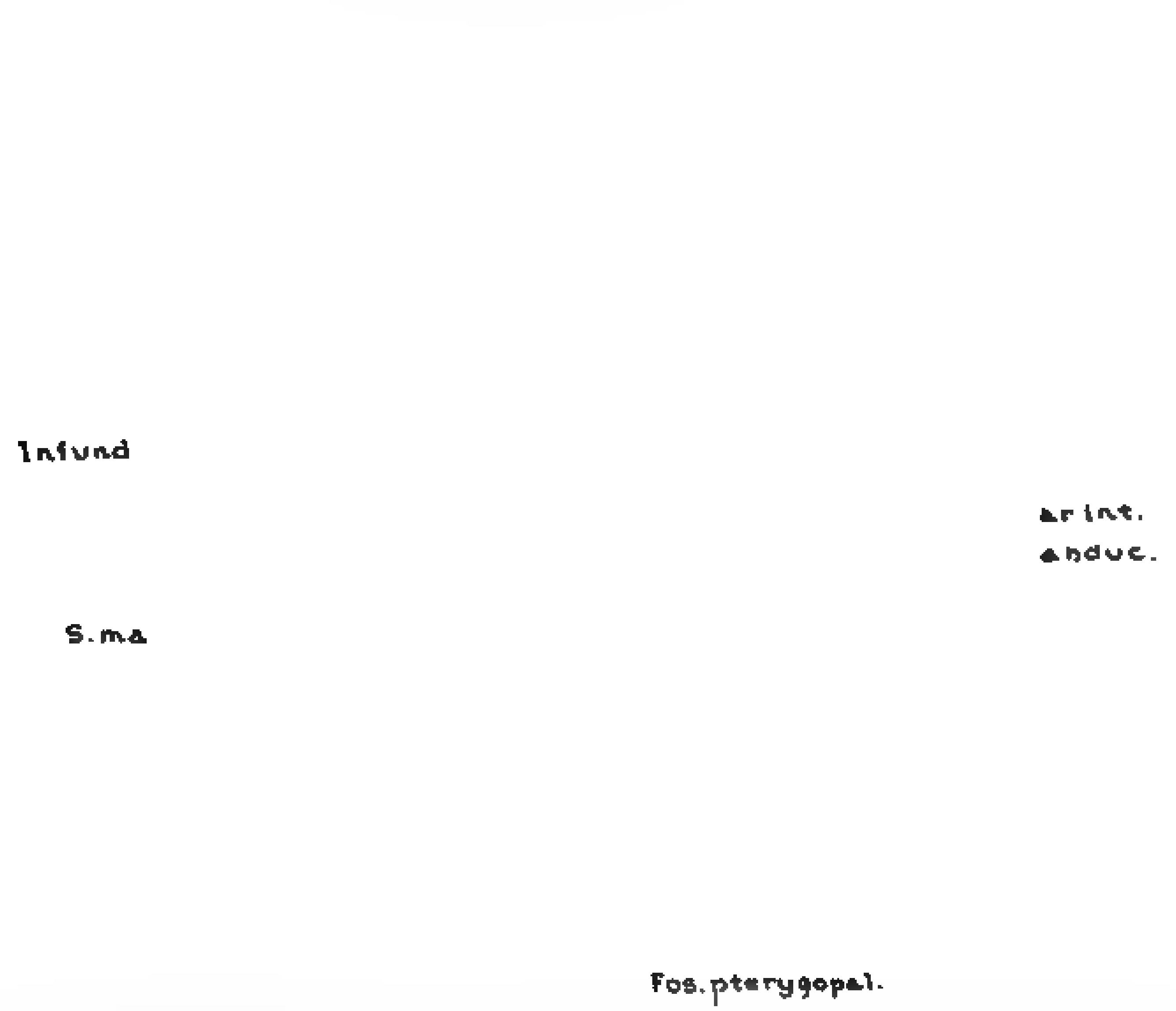


Fig. 16.—Specimen from a child five years, ten months, and twenty two days old. Lateral view of frontal, ethmoidal, sphenoidal, and maxillary areas to show the extent of pneumatization present and the relation of the sinuses. (Series D, No. 45.)

Osseous wall, between sinus sphenoidalis and fossa pterygopalatina, is ½ mm thick, while from sinus cavity to foramen rotundum is 1 mm Sinus frontalis developed from an infundibular cell. *Cel.eth.ant.*, Cellulæ ethmoidales anterior; *Cel.eth post*, cellulæ ethmoidales posterior; *S.sph.*, sinus sphenoidalis; *For.optic.*, foramen opticum; *A car.int*, arteria carotis interna, *N.abduc.*, nervus abducens, *For rotundum*, foramen rotundum; *Fos pterygopal*, fossa pterygopalatina, *S.max.*, sinus maxillaris; *Infund.eth.*, infundibulum ethmoidale; *S.front.*, sinus frontalis.

sphenoids with the basisphenoid takes place shortly after birth. The centers which give rise to the alisphenoids extend into the external pterygoid plates.

The skull at birth (Fig. 9), when compared with the adult skull (Fig. 10), shows a marked difference in the relative proportions between the cranial and facial regions. It has been estimated that the volumes of the two portions have a ratio of 8:1 in a child at birth, 4:1 at five years of age and 2:1 in the adult skull (Froriep). These differences are chiefly due to the small vertical diameters of the maxillæ, the rudimentary condition of the alveolar borders of the maxillæ and mandible, and the small size of the nasal fossæ at birth. Increase in the diameters of the facial area is associated with the pneumatization of the

maxillæ, ethmoid, frontal and sphenoid bones. The extent of accessory sinus development in childhood has been underestimated by the vast majority of authors, the scarcity of anatomic material showing the conditions present during childhood being probably responsible for the erroneous conclusions.

So important is the role played by the accessory sinuses in the transformation of the bones of the infantile face into the adult type that we will consider their development separately. We find that all ethmoidal cells, the frontal and maxillary sinuses have their origin from preformed grooves or furrows between the folds which develop on the lateral nasal wall (Figs. 3, 4, and 5), while the sphenoidal sinus develops from the sphenoethmoidal recess (Fig. 7).

In embryos of thirty-eight to forty days, the concha nasalis inferior ap-

Fig. 17.—Specimen from a child six years, ten months, and twenty days old. By sagittal sections the lateral portions of the frontal, ethmoidal, and maxillary areas have been removed. (Series D, No. 53.)

The osseous ridges on the medial wall of the sinus maxillaris are unusually prominent. The largest one overlies the ductus nasolacrimalis. There were two lacrimal sacs present, the superior portion of the duct being blind. Note presence of ostium maxillare accessorium and the proximity of the mucous cyst. *S.front.*, Sinus frontalis; *Cel.infund.*, cellulæ infundibulares; *Fos sac lacr.*, fossæ sacci lacrimales; *Ost max.*, ostium maxillare; *Ost max. acces.*, ostium maxillare accessorium; *N max.*, nervus maxillaris; *N.mandib.*, nervus mandibularis; *Gang.semi.*, ganglion semilunare (Gasseri); *N.abduc.*, nervus abducens; *A.car.int.*, arteria carotis interna, *N troch.*, nervus trochlearis; *N oculom.*, nervus oculomotorius, *N.ophthal.*, nervus ophthalmicus, *N optic.*, nervus opticus; *Cel eth.post.*, cellulæ ethmoidales posterior; *Cel b.eth.*, cellula bullæ ethmoidalis.

pears as a bulging of the inferior portion of the lateral nasal wall, immediately superior to the portion from which the palatal processes develop (Schaeffer). From the fortieth to the forty-third day the ethmoidal fold appears superior and slightly dorsal to the fold representing the concha inferior. From the ethmoidal fold, the ethmoidal conchæ develop as the nasal cavity increases in its superoinferior diameter (Figs. 3, 4, and 5). As the conchæ become more

prominent medially, there is also a lateral deepening of the grooves immediately beneath the conchæ, each groove becoming a meatus which is named in accordance with the concha beneath which it lies. In my series of 202 postnatal lateral nasal walls, four ethmoidal conchæ were present in 2 per cent of the cases, three in 92 per cent, and two in only 6 per cent, yet two is the number most frequently described in anatomic works. In one 188 day fetus five ethmoidal conchæ were demonstrable (Fig. 8).

In the latter part of the third month of intrauterine life, the conchæ nasales assume approximately their definitive outlines, and the meatuses become well marked. In the meatus medius two accessory folds, the processus uncinatus and the bulla ethmoidalis, are distinctly demonstrable (Figs. 4 and 5). During the fourth fetal month, the cellulæ ethmoidales develop as invaginations of the

Fig. 18.—Specimen from a child six years, ten months, and twenty days old. Lateral view of this specimen is shown in Fig. 17. (Series D, No. 53.)

Sagittal section ½ mm. to the left of median line, showing extent of sinus sphenoidalis and also the relation of the structures entering into the formation of the septum nasi. *Cr.gal.*, Crista galli; *Lam.perpend.*, lamina perpendicularis; *S.sph.*, sinus sphenoidalis. *Hypoph.*, hypophysis, *Ton.phar.*, tonsilla pharyngea; *Ost.tub.aud.*, ostium pharyngeum tubæ auditivæ; *Cart.sept na.*, cartilago septi nasi.

nasal mucosa extending into the lateral masses of the ethmoid from the primitive grooves in the lateral nasal wall (Fig. 6). The invaginations are cylindric extensions of the mucosa, in which the epithelial surfaces are in contact, but, as their diameters increase, lumina develop within the cylindric processes, which by the sixth fetal month usually show distinct cell formation.

Ethmoid cells are best classified into anterior and posterior groups. All ethmoidal cells having their ostia inferior to the attachment of the concha nasalis media belong to the anterior group, while those having their ostia superior to the concha media belong to the posterior group (Fig. 23). This classification holds good regardless of how far the more distant portions of any ir-

regularly developed cells of either group may invade the region ordinarily occupied by cells of the other group.

Each group is subdivided as follows:

Cellulæ ethmoidales anterior	Cellulæ frontales. Cellulæ infundibulares. Cellulæ bullæ ethmoidales.
Cellulæ ethmoidales posterior	Cells communicating with the meatus superior. Cells communicating with the meatus supremus I. Cells communicating with the meatus supremus II.

Seydel observed that an ethmoid cell having its origin from any given meatus, did not communicate with any cell having origin from any other meatus. Zuckerkandl took exception to this statement, but certainly every specimen in my series supports Seydel's view.

On the superior portion of the anterolateral wall of the recessus chonchalis,

Fig. 19.—Specimen from a child eight years, two months, and ten days old. (Series D, No. 59.)

Lateral view of frontal, ethmoidal, and maxillary areas. Note that the sinus frontalis developed from a cell having its origin from the suprabullar furrow. The right sinus frontalis had a similar origin, these two being the only such instances found in the entire series. The supero-inferior extent of the cellulæ ethmoidales is in this case greater than usually found at this age. *B eth.*, Cellulæ bullæ ethmoidales; *Cel.eth. post.*, cellulæ ethmoidales posterior; *Fos pterygopal.*, fossa pterygopalatina; *Ost max.acces.*, ostium maxillare accessorium; *Ost.max.*, ostium maxillare; *Fos sac lacr.*, fossa sacci lacrimalis; *Infund.eth.*, infundibulum ethmoidale; *S.front.*, sinus frontalis.

a large majority of late fetal and early childhood specimens show from one to three small ridges developing from the posteromedial surface of the processus frontalis of the maxilla. These ridges are the conchæ frontales (Fig. 21), and from the furrows or depressions between them, or between them and the surrounding walls of the recess, the celluæ frontales develop. The infundibulum ethmoidale is a gutter-like groove lying lateral to the processus uncinatus (Figs. 4, 15, and 27). Infundibular cells develop as extensions from the infundibulum (Figs. 4 and 15). Bullar cells develop in the bulla ethmoidalis, as extensions from the suprabullar furrow (81.7 per cent) or from the infrabullar furrow (19.3 per cent).

The manner in which the processus uncinatus is attached to the agger nasi

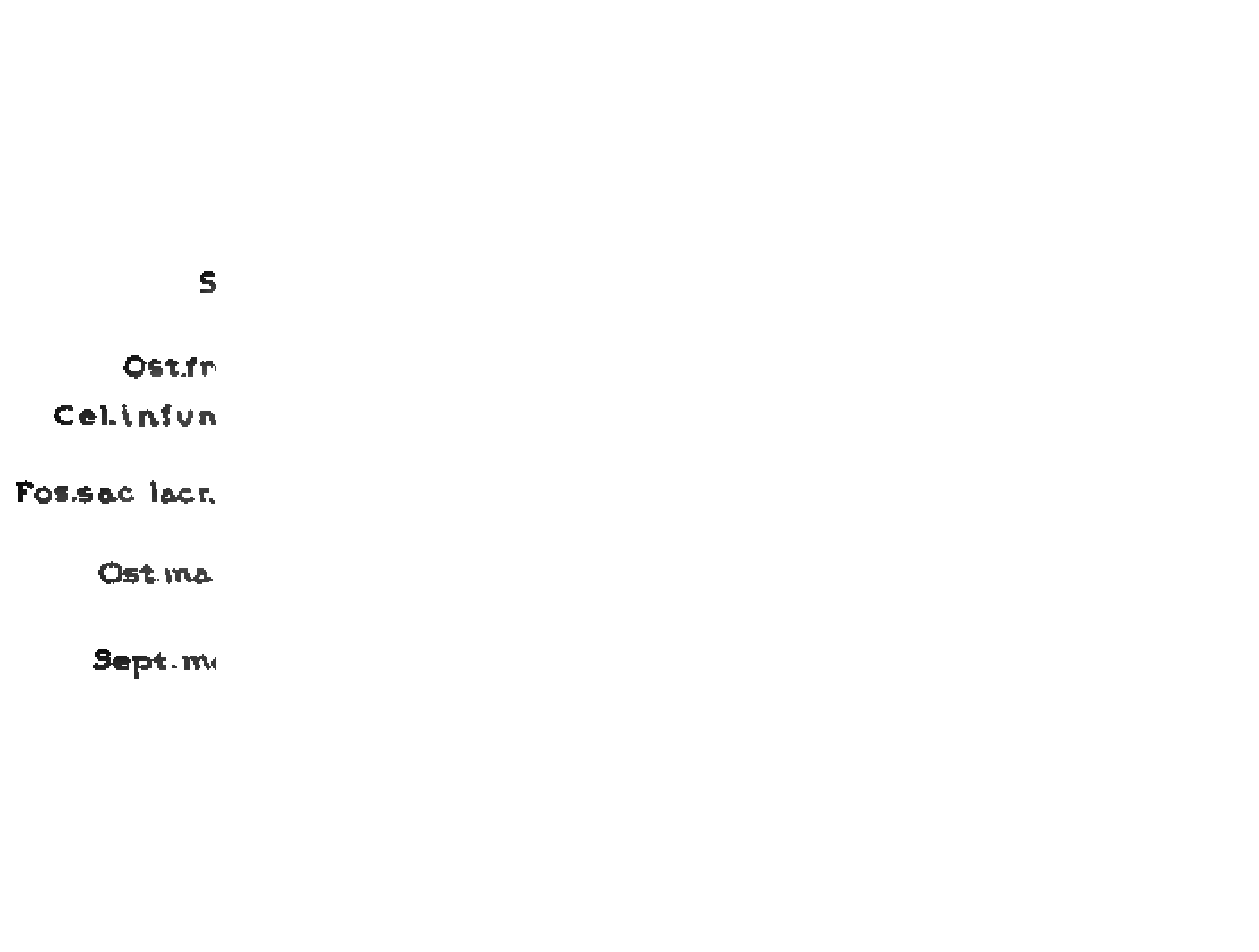


Fig. 20.—Specimen from a child eight years, eight months, and one day old. (Series D, No. 63)

Lateral view of frontal, ethmoidal, and maxillary sinus areas, the lateral portion of each having been removed by sagittal cuts. Note that the sinus frontalis developed directly from the infundibulum ethmoidale. Note also the incomplete septa in the sinus maxillaris. *Cel.eth.ant.*, Cellulæ ethmoidales anterior, *Cel.eth.post.*, cellulæ ethmoidales posterior; *N.optic.*, nervus opticus; *Sept.max.*, septulæ maxillares; *Ost.max.*, ostium maxillare; *Fos.sac.lacr.*, Fossa sacci lacrimalis; *Cel.infund.*, cellulæ infundibulares; *Ost.front.*, ostium frontale; *S.front.*, sinus frontalis.

and the character of the attachment of the anterior portion of the concha media exert the greatest influence upon the proportion between the number and size of the frontal and infundibular cells. If the processus uncinatus is attached to the posterolateral portion of the agger nasi and the anterosuperior attachment of the concha media is high up on the lateral nasal wall, then the frontal cells are apt to be well developed (Fig. 21). However, if the anterior attachment of the processus uncinatus is more medial in position, and the anterosuperior attachment of the concha media is situated lower on the lateral nasal wall, then the frontal recess is small and the frontal cells are apt to be deficient in de-

velopment, and there is usually a corresponding increase in both the number and the extent of development of the infundibular cells (Figs. 17 and 24).

These variations are important because of the influence which they have on the development of the frontal sinus, which always has its origin from the anterior ethmoidal area. In 202 cases the following were the five ways in which development of the sinus frontalis occurred and the percentage of each variety:

1. By the extension of one of the cellulæ frontales, 41 per cent (Fig. 23).

2. By the extension of the recessus conchalis, no cellulæ frontales being demonstrable, 18.4 per cent.

Fig. 21.—Specimen from a child nine years, one month, and nine days old. (Series D, No. 64.)

Incision through maxilla is ½ mm. to the right of median line, in the frontal region 1 mm. to the left, and through the body of the sphenoid is 5 mm. to the left of median line. The anterior portion of the concha media and a small portion of the frontal bone have been removed to show the structures entering into the formation of the lateral nasal wall, and also the location of the ostia frontalia. In this case there are three sinus frontales—one in the right side and the two in the left side here illustrated. Of the more lateral sinus frontalis, only the ostium is shown (*Ost front.(b)*; the sinus, however, extends to the same height as the medial one shown in the illustration. Note that neither ostium comes into direct relation to the infundibulum ethmoidales. In the suprabullar furrow ostia of bullar cells are shown. *S front.*, Sinus frontalis; *C front.*, conchæ frontales; *Ost.tub.aud.*, ostium pharyngeum tubæ auditivæ; *S.sph.*, sinus sphenoidalis; *B.eth.*, bulla ethmoidalis; *Proc unc*, processus uncinatus; *Ost.front.(b)*, ostium of the lateral sinus frontalis; *Ost front.(a)*, ostium of the medial sinus frontalis.

3. By the extension of a cellula ethmoidalis anterior having its origin from the suprabullar furrow, 1 per cent (Fig. 19).

4. By direct extension of the infundibulum ethmoidale, 15.6 per cent (Fig. 20).

5. By the extension of one of the cellulæ infundibulares, 24 per cent (Figs. 16 and 29).

Thus we find that sinus frontales developing by the first three methods, a

total of 60.4 per cent, of the cases in my series, communicate with the meatus medius without communicating with the infundibulum ethmoidale. Sinuses which develop by the fourth and fifth methods, however,—a total of 39.6 per cent, of the cases—communicate with the meatus medius via the infundibulum and the hiatus semilunaris. In the latter cases there is thus a closer relationship between the sinus frontales and the sinus maxillares, since the ostium maxillare in all cases is situated in the inferolateral wall of the infundibulum.

Ordinarily only one frontal sinus develops on each side (Fig. 22), but in a few instances (3.5 per cent, in this series), supernumerary sinuses are found

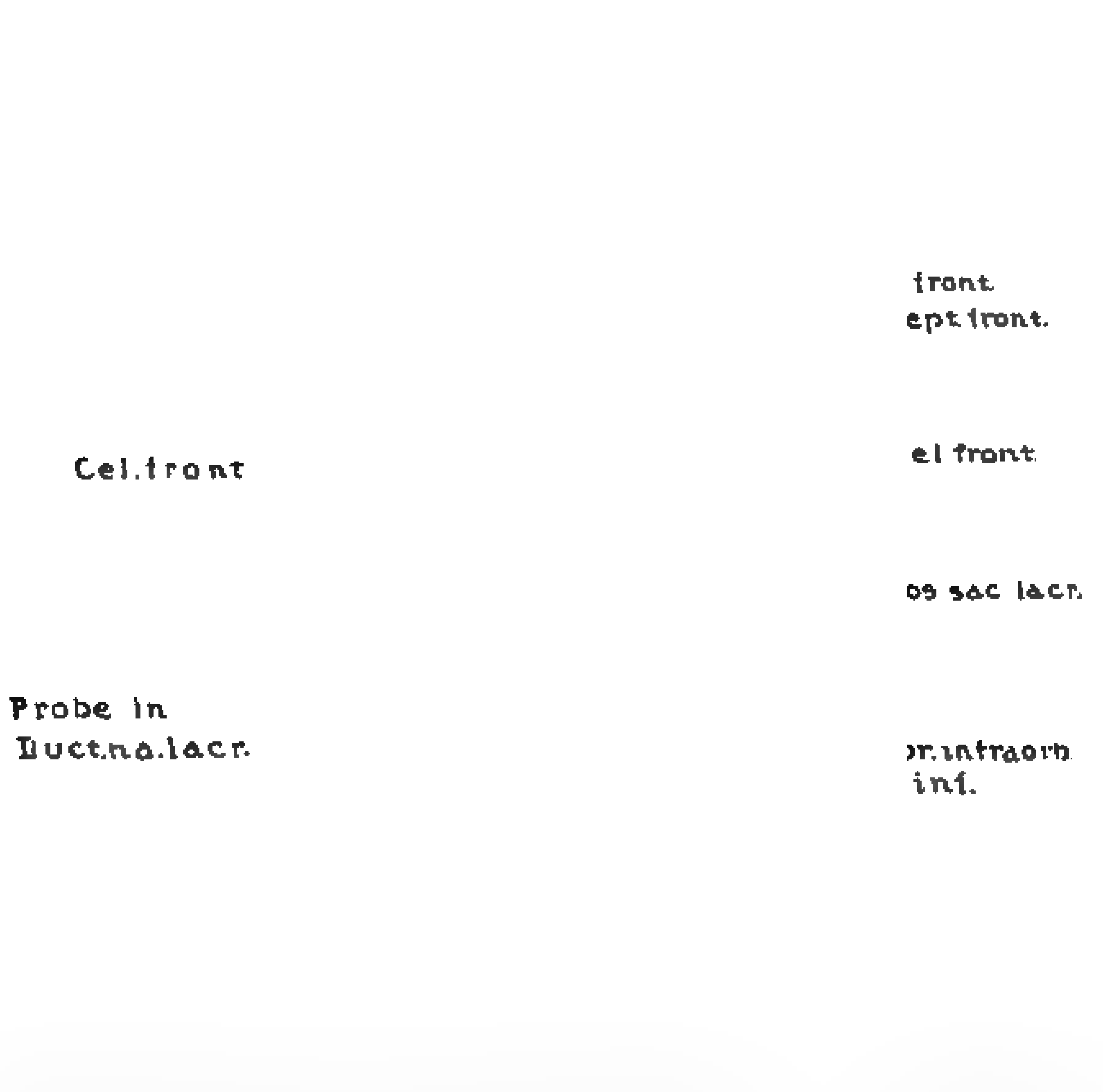


Fig. 22.—Specimen from a child twelve years, nine months, and twelve days old. (Series D, No. 69.)

Anterior view of a coronal section cut 12 mm. posterior to the nasion, to show superior and lateral extent of the sinus frontales, also the relations of the cellulæ frontales. The frontal sinuses and all cells shown in this illustration have their ostia medial to the uncinate processes. Note the relations of the ductus nasolacrimalis. *S.front.*, Sinus frontalis; *Sept.front.*, septum frontale; *Cel.front.*, cellulæ frontales; *Fos. sac.lacr.*, fossa sacci lacrimalis; *For.infraorb.*, foramen infraorbitalis; *Duct.na.lacr.*, ductus nasolacrimalis.

(Fig. 27). Supernumerary sinus frontales may develop from two cellulæ infundibulares, from two cellulæ frontales, or from any combination of the above described five routes of development of single sinuses.

Although distinct cellulæ ethmoidales anterior are demonstrable during the latter months of fetal life, yet, in the average case, one can not say definitely which of the extending processes of pneumatization represents the primitive sinus frontalis until after the sixth month of postnatal life. In some specimens

the probable route of development can be determined with a fair degree of certainty at the time of birth or shortly thereafter (Fig. 12) while in other cases the distinct beginning of a sinus frontalis is not demonstrable until near the end of the first year (Fig. 14). From whichever of these sources a frontal sinus may have its origin, the process of pneumatization gradually extends from that portion of the anterior ethmoidal area toward and into the inferior portion of the frontal bone (Fig. 16). The sinus, surrounded as it is by a thin lamina of compact bone, then advances toward the ascending portion of the frontal bone, advancing as the cancellous bone is resorbed. In an average case, the sinus be-

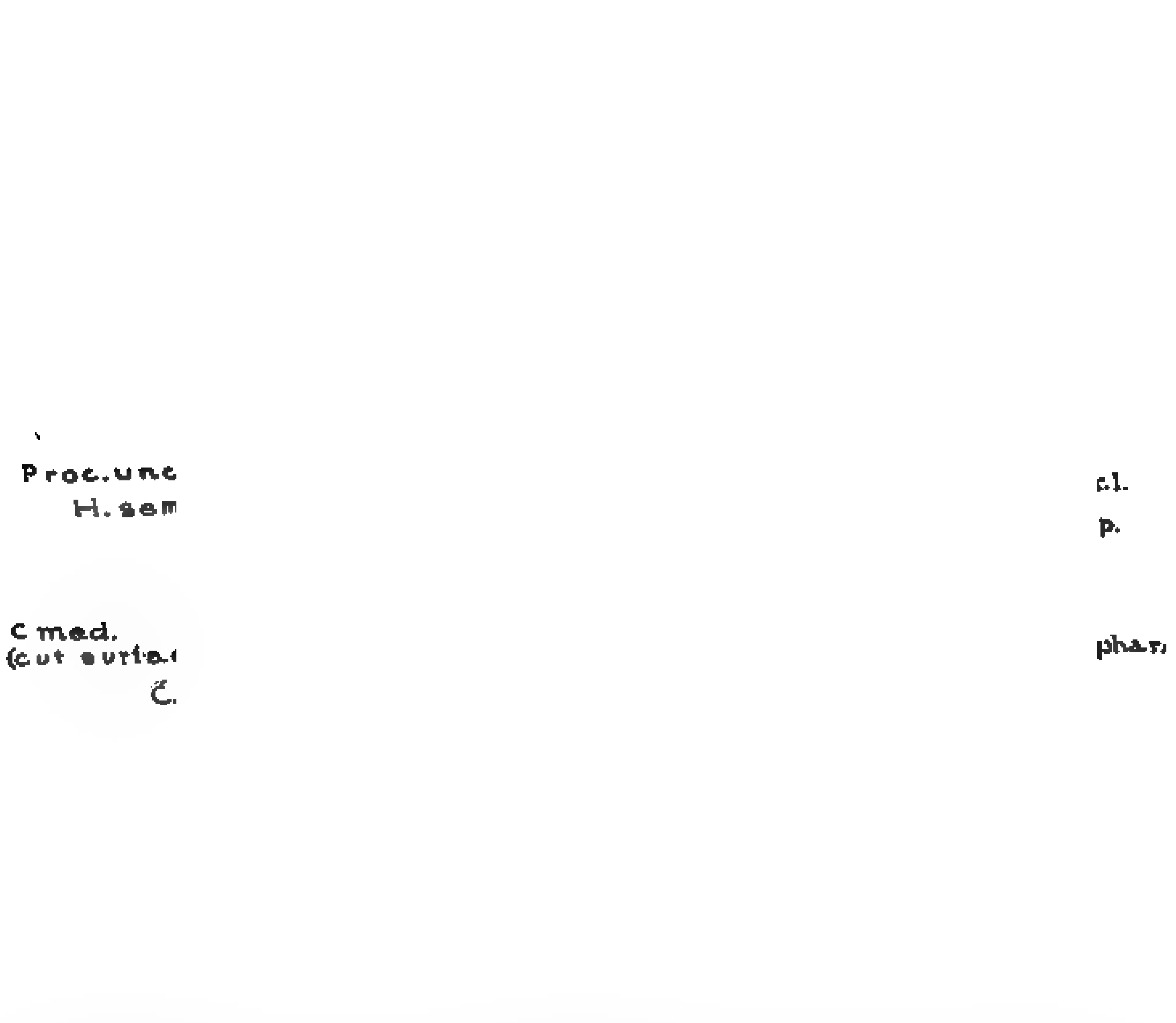


Fig. 23.—Specimen fourteen years and seven months old. (Series D, No. 73.)

Sagittal section, cut 4 mm. to the right of the median line, thus removing the medial portions of the concha inferior and concha media, and the medial anterosuperior portions of the concha superior and concha suprema I. The relations of the structures forming the lateral nasal wall and the positions of the ostia of the cellulæ ethmoidales are thus clearly shown. *1.*, Probe through ostium frontale; *B.eth.*, bulla ethmoidalis; *Cel.eth post.*, cellulæ ethmoidales posterior; *2*, probe through ostium of most posterior ethmoidal cell; *S.sph.*, sinus sphenoidalis; *Hypoph.*, hypophysis; *C.supr.I*, concha suprema I; *C.sup.*, concha superior; *Ton.phar.*, tonsilla pharyngea; *Ost.tub.aud.*, ostium pharyngeum tubæ auditivæ; *C.inf.*, concha inferior, *C.med.*, concha media; *H.semi.*, hiatus semilunaris; *Proc.unc.*, processus uncinatus.

gins its ascent into the vertical portion of the bone during the second year. As the sinus advances into the vertical portion of the bone, its posterior wall is always thin and consists almost entirely of compact bone, while the anterior wall, as found in different specimens, varies greatly in its thickness and usually contains a considerable amount of diploë. The sinuses of the two sides are seldom quite symmetric, though the general outline often suggests an attempt at sym-

metry. Not uncommonly, however, the two sinuses are of an entirely different form. The degree of supraorbital or superciliary prominence can not be taken as an indication of the size of the sinuses to be found beneath them. The adult sinus shows marked irregularity, varying from the form which fails to reach the level of the supraorbital margins to the form extending far above the superciliary ridge and laterally over the entire supraorbital area. An average sinus

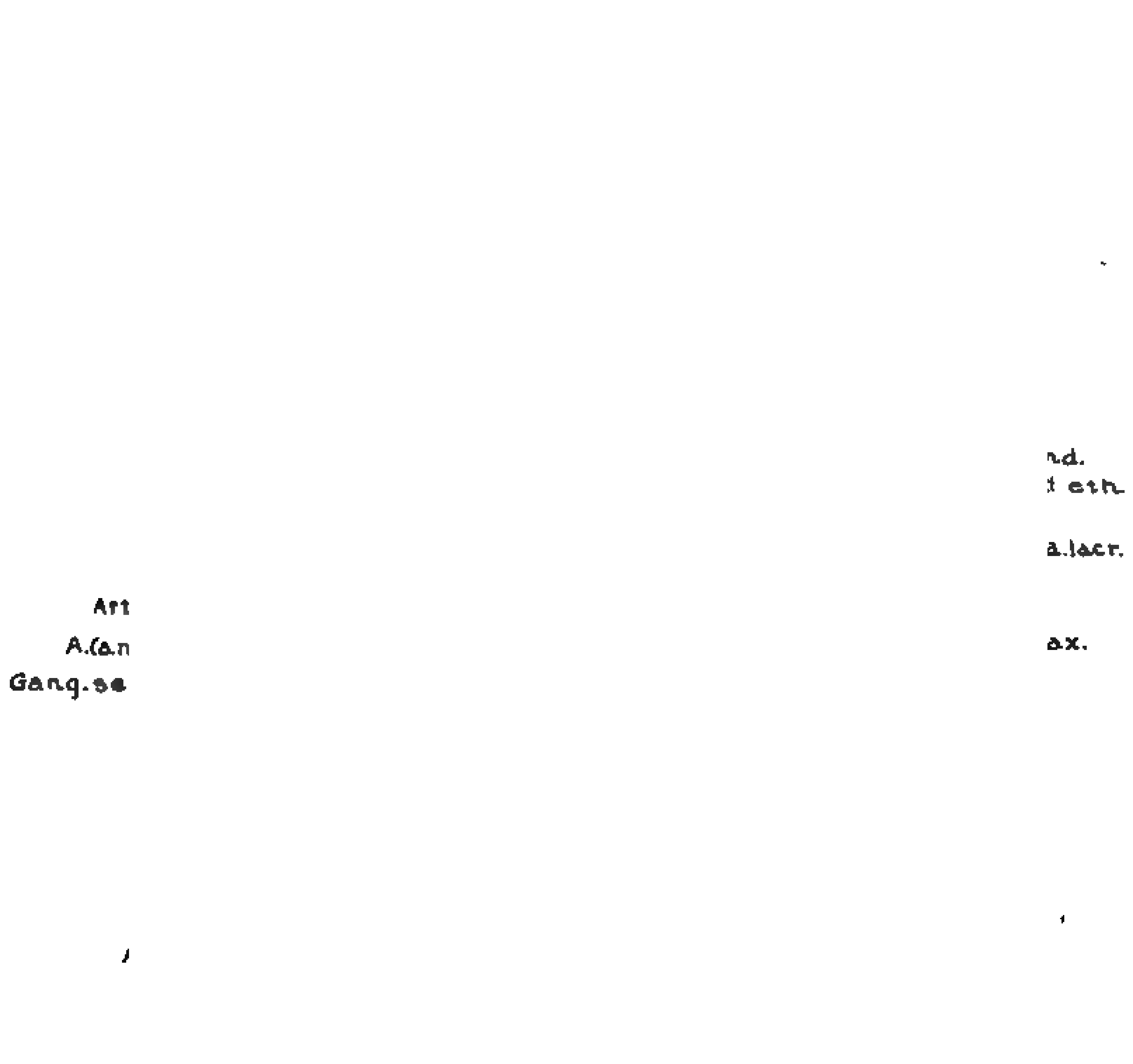


Fig. 24.—Specimen fifteen years, nine months, and twenty-six days old. (Series D, No. 76.)

Lateral portions of the frontal, ethmoid, maxillary, and sphenoidal areas have been removed by sagittal incisions. Note the marked extent of the sinus sphenoidalis into the pterygoid process. The ridge which is seen on the floor of the sinus sphenoidalis overlies the nervus canalis pterygoidei (Vidii) The sinus maxillaris extends 11 mm. below the level of the nasal floor. *S front.*, Sinus frontalis; *Cel.front.*, cellulæ frontales; *Cel.infund.*, cellulæ infundibulares, *Infund.eth.*, infundibulum ethmoidale; *Duct na lacr*, ductus nasolacrimalis; Ost.max, ostium maxillare; *S.sph.*, the portion of sinus sphenoidalis extending into the pterygoid area; *Art.car int*, arteria carotis interna; *Gang.semi*, ganglion semilunare, *A anom*, anomalous branch of carotid artery, *N troch.*, nervus trochlearis; *N oculom.*, nervus oculomotorius; *N. optic*, nervus opticus; *Cel eth.post*, cellulæ ethmoidales posterior; *Cel.b.eth*, cellulæ bullæ ethmoidales.

frontalis extends laterally to a point just medial to the supraorbital notch, and superiorly to the lower border of the superciliary ridge.

Beginning development of the sinus sphenoidalis is demonstrable in sixty-five-day embryos as an invagination of the mucosa in the recessus sphenoeth-

moidalis extending into the posterior portion of the cartilaginous nasal capsule, the advancement of the pouching process being in a posteroinferior and slightly lateral direction. The primitive sphenoidal sinuses thus come to lie posterior to the nasal capsule and anterolateral to the body of the sphenoid bone. In the anteroinferior wall of the primitive sinus there develops an ossification center for the concha sphenoidalis, or ossiculum Bertini (Fig. 7), ossification of which is well advanced in term fetuses, but it does not become firmly attached to the body of the sphenoid until the second or third year.

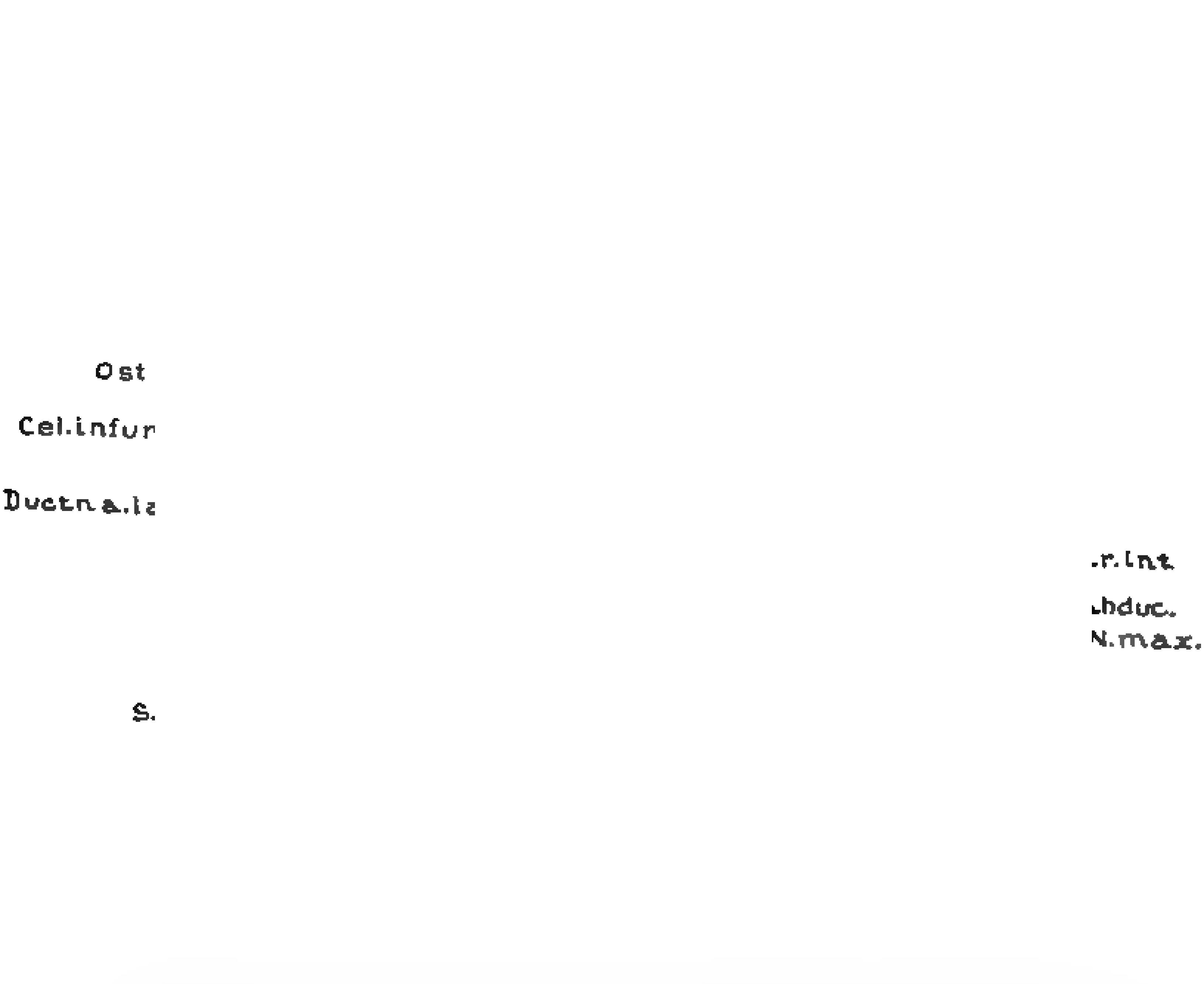


Fig. 25.—Specimen, eighteen years, eleven months, and ten days old. (Series D, No. 85.)

Lateral view of the frontal, ethmoidal, maxillary, and a portion of the sphenoidal areas. Sinus frontalis developed from an infundibular cell Note that the ostium frontale is not in the most inferior portion of the floor of the sinus. *Cel.b.eth*, Cellulæ bullæ ethmoidales; *Cel.eth.post.*, cellulæ ethmoidales posterior; *Ost.sph*, ostium sphenoidale; *S.sph*, sinus sphenoidalis, *A car.int.*, arteria carotis interna; *N.abduc.*, nervus abducens; *N max.*, nervus maxillaris; *Tub.aud.*, tuba auditiva (Eustachii); *S.max.*, sinus maxillaris; *I*, probe through ostium maxillare; *Duct.na lacr*, ductus nasolacrimalis; *Cel.infund.*, cellula infundibularis, *Ost.front.*, ostium frontale; *S.front.*, sinus frontalis.

The extent of sphenoidal pneumatization is more irregular than that of any other accessory sinuses, showing wider variations in specimens of approximately the same age. In average cases the rate of development is such that by the eighth to tenth year the posterosuperior portion of the sinus lies beneath the anterior portion of the sella turcica (Fig. 18), and by the fifteenth year is usually separated from the hypophysis by a very thin lamina of compact bone. An-

terosuperiorly, the sinus is in close relation to the most posterior of the ethmoid cells, but in no case is there a direct communication between the sinus and such cells (Figs. 16 and 25). In many instances the sinuses not only fill the body of the sphenoid, but may extend far into the clivus, into the pterygoid processes (Fig. 24), into the greater or lesser wings of the sphenoid, or in some instances into the orbital process of the palate bone. The sphenoidal septum is always

Fig. 26.—Specimen nineteen years and twenty-eight days old. Lateral view of frontal, ethmoidal, and maxillary areas. (Series D, No. 86.)

Note presence of an aberrant ethmoidal cell which has invaded the postero-superior portion of the maxilla. The ostium of this cell is in the midportion of the lateral wall of the meatus superior. When this type of development is more extensive, a "double maxillary sinus" is formed, as described by Zuckerkandl. *Cel.b.eth.*, Cellulæ bullæ ethmoidales; *Cel.eth.post.*, cellulæ ethmoidales posterior, *N.optic.*, nervus opticus; *N.abduc.*, nervus abducens; *N.oculom.*, nervus oculomotorius; *N.troch.*, nervus trochlearis; *Gang. semi.*, ganglion semilunare; *S.max.*, sinus maxillaris; *Cel.eth.post.*, (aberrant), aberrant cellula ethmoidalis posterior; *Infund.eth.*, infundibulum ethmoidale; *Cel.infund.*, cellula infundibularis; *S.front.*, sinus frontalis.

complete, but is seldom medial in position, due to irregularities in the rate of resorption in the developing sinuses of the two sides.

The sinus maxillaris is the most constant of the nasal accessory sinuses, and the extent of its development is also the most regular, as is shown by comparing the tables of measurements given by the different observers.

In embryos eighty-five days old, the primitive sinus maxillaris appears as

a lateral outpouching of mucosa from the inferolateral wall of the infundibulum ethmoidale, slightly anterior to its midpoint anteroposteriorly. This point of primary lateral pouching persists as the ostium maxillare, while by the combined processes of resorption and expansion the sinus comes to occupy the greater part of the body of the maxilla. In early childhood the general outline of the sinus is rather ovoidal (Figs. 12 and 14), but after the fifth year it gradually changes into a quadrilateral pyramidal form which persists and becomes more pronounced as the usual adult type (Figs. 16, 17, 19, 24, and 25).

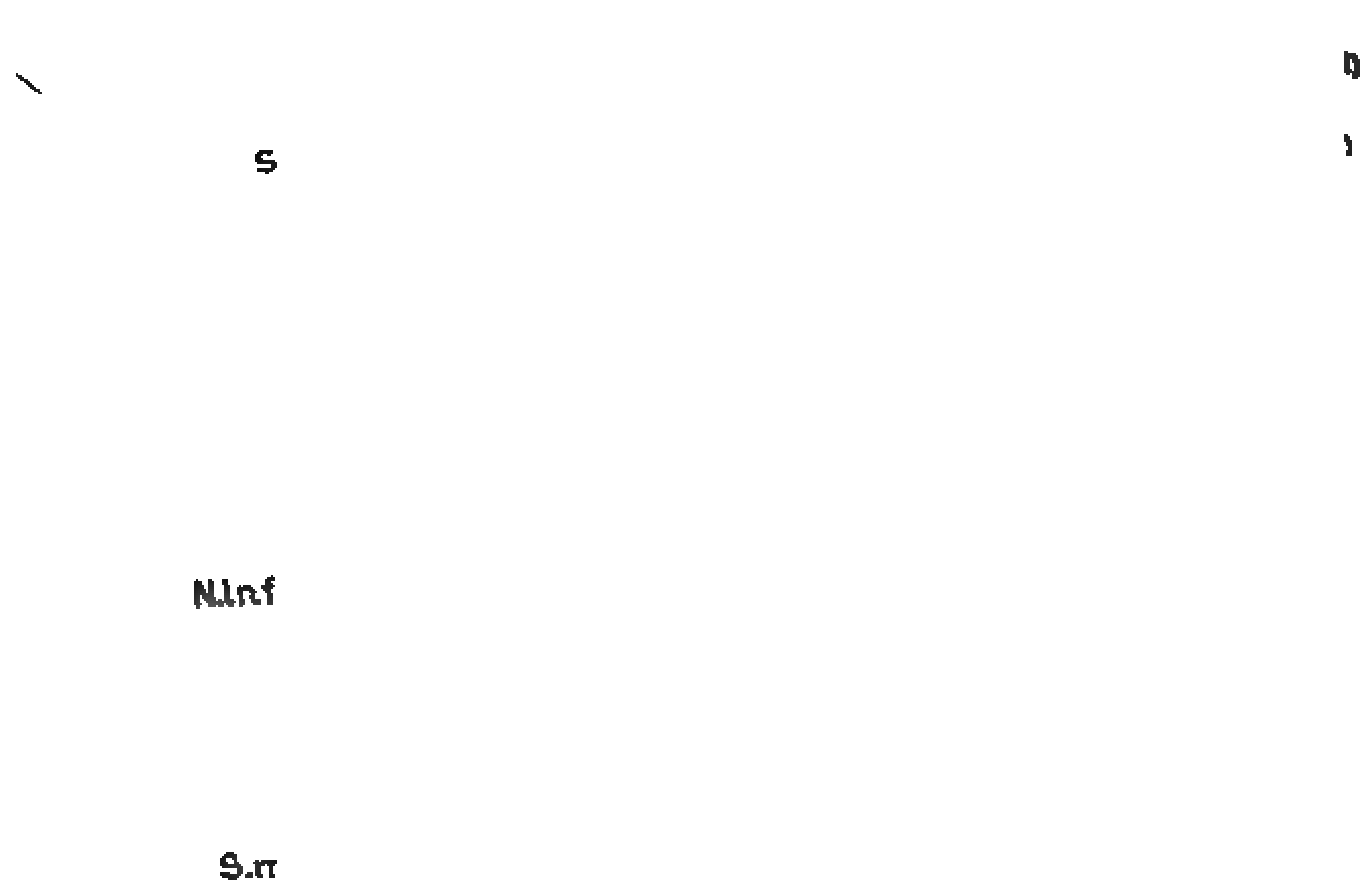


Fig. 27.—Specimen twenty years and five months old.—(Series D, No. 90.)

Posterior view of a coronal section 18 mm. posterior to the nasion. The posterior walls of the sinus have been removed to show the relations of the sinuses and their ostia. Note that on the right side there are two distinct sinus frontales present. The more medial of these two sinuses developed from a cellula frontalis, medial to the processus uncinatus, while the lateral one developed from the infundibulum. *I*, Probe through the ostium of the medial sinus frontalis, the ostium being anterior to the cellula frontalis shown in illustration; *S.front.*, sinus frontalis; *Cel.front.*, cellula frontalis; *Infund.eth.*, infundibulum ethmoidale; *C.med.*, concha media; *Ost.max.*, ostium maxillare; *C.inf.*, concha inferior; *S.max.*, sinus maxillaris; *N.infraorb.*, nervus infraorbitalis; *Proc.unc.*, processus uncinatus; *B.eth.*, bulla ethmoidalis (extreme anterior portion); *Cr.gal.*, crista galli.

In a child eight days old (Fig. 12), the sinus diameters were 8.2 mm. anteroposteriorly, 3.3 mm. vertically, and 2.8 mm. laterally. Up until the eighth year the diameters of the sinus maxillaris increase at a rate which was found to average approximately 2 mm. each year in both the vertical and the lateral diameters, and 3 mm. anteroposteriorly. After the eighth year the development

advances more slowly in all directions, reaching in the fifteenth to the eighteenth year a form which approximates the adult type, later changes being shown chiefly in the posteroinferior angle, which descends as the third molar tooth erupts. The floor of the sinus maxillaris, in an average case, reaches a level equal to that of the floor of the nasal fossa during the eighth year, and in the majority of cases thereafter is from 1 mm. to 5.5 mm. below the level of the nasal floor.

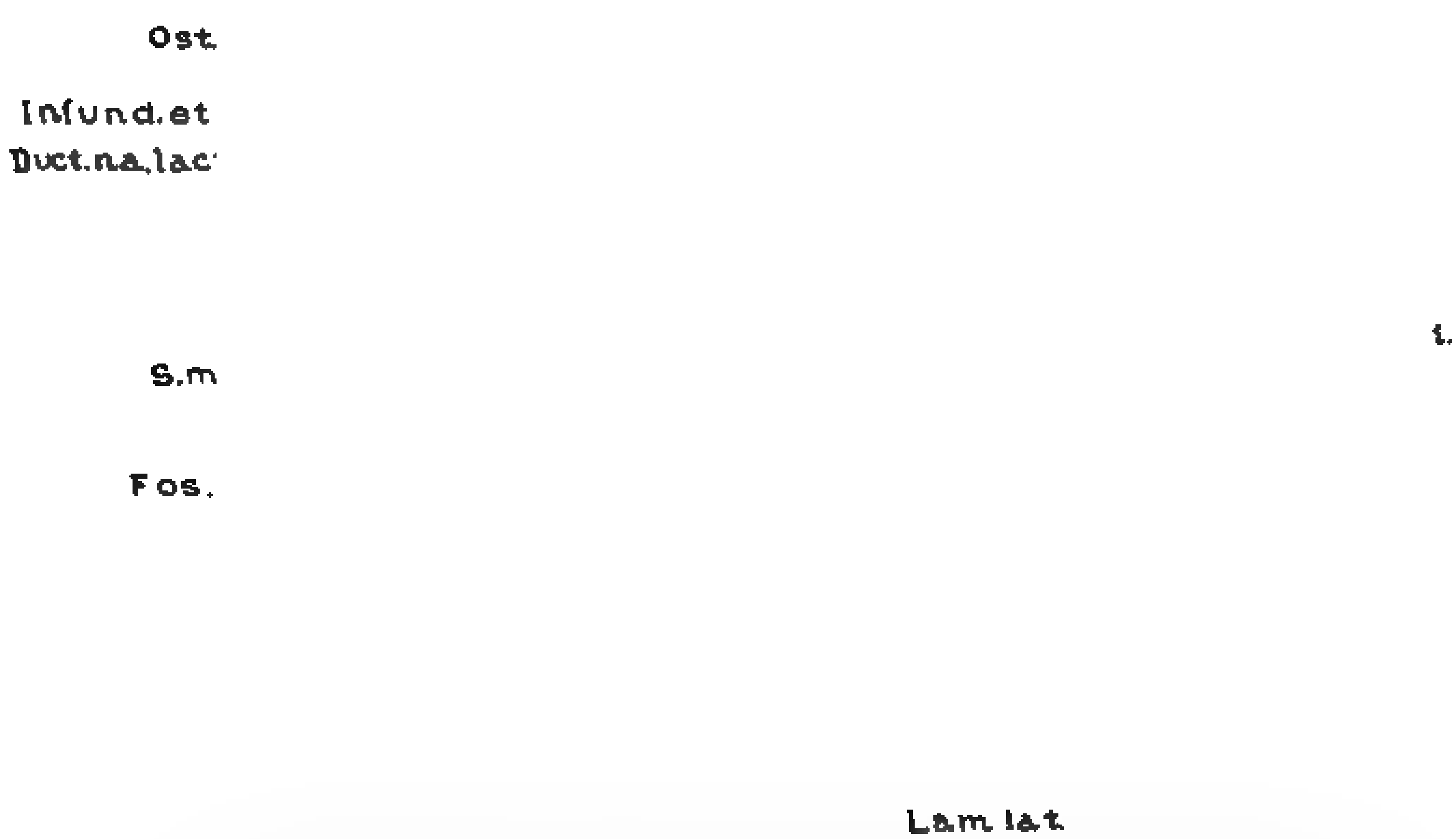


Fig. 28.—Specimen twenty-three years, seven months, and thirteen days old. Lateral view of frontal, ethmoidal, maxillary, and a portion of the sphenoidal areas. (Series D, No. 94.)

The dotted line outlines the extent of the sinus sphenoidalis. The sinus sphenoidalis and the sinus maxillaris are both unusually small for an adult. (Compare with preceding figures.) Note also the unusually large fossa canina. The sinus frontalis developed from an infundibular cell. *Cel.eth.ant.*, Cellulæ ethmoidales anterior; *Cel.eth.post.*, cellulæ ethmoidales posterior; *S.sph.*, sinus sphenoidalis; *N.optic.*, nervus opticus; *A.car.int.*, arteria carotis interna, *N.abduc.*, nervus abducens; *Gang.semi.*, ganglion semilunare; *Tub.aud.*, tuba auditiva; *Lam.lat.*, lamina lateralis processus pterygoidei; *Fos.ca.*, fossa canina; *Duct.na.lacr.*, ductus nasolacrimalis; *Infund.eth.*, infundibulum ethmoidale, *Ost.front.*, ostium frontale; *S.front.*, sinus frontalis.

In the development of the maxillary sinus (also in ethmoidal, frontal and sphenoidal sinuses), the pouching mucosa rests upon a layer of compact bone as the process of pneumatization extends into the body of the bone, the layer of compact bone advancing as the resorption goes on in the underlying cancellous bone. The floor of the sinus maxillaris, in all stages of its development, is in

close relation to the teeth (Figs. 12, 16, and 19), and the increase in the vertical diameter of the sinus is found to be much more of a process of expansion as the body of the maxilla increases in size, than it is one of resorption of cancellous bone previously occupying the area.

The number of teeth, the roots of which are in close relation to the floor of the sinus, shows marked variations. However, the typical floor may be considered as one which overlies the roots of all the molars and the posterior por-

Fig. 29.—Specimen thirty-five years old Sagittal section from which the soft parts had been removed by maceration. (Series E, No. 5.)

Concha nasalis media has been removed to allow a better view of the processus uncinatus and the bulla ethmoidalis. The sinus frontalis developed from an infundibular cell. *1.*, Probe through ostium frontale; *2.*, probe through ostium sphenoidale; *B eth*, bulla ethmoidalis; *C.med.*, concha media (cut surface); *Lam.crib.*, lamina cribrosa; *C sup.*, concha superior; *C.supr.I*, concha suprema I; *For.sph.pal.*, foramen sphenopalatinum; *Lam.med.*, lamina medialis processus pterygoidei; *Os pal.*, pars perpendicularis ossis palatina, *C.inf.*, concha inferior; *Proc.eth.*, processus ethmoidalis conchæ nasalis inferior; *Os lacr.*, os lacrimal, *Proc front max.*, processus frontalis maxillæ; *Proc.unc.*, processus uncinatus; *H.semi.*, hiatus semilunaris; *Ag.na.*, agger nasi, *S.front*, sinus frontalis.

tion of the second premolar. In many cases only the molars come into close relation, and in a few cases only the second and third molars are directly beneath the floor. It is a very extensive floor, which advances so far anteriorly as to overlie the first premolar, and in my series no case was found in which the root

of the canine was in relation to the floor. In a few of the largest sinuses, however, the root of the canine extended well up into the anterior wall of the sinus.

Regardless of the extent of the irregularities in the floor of the sinus produced by resorption of the cancellous bone surrounding the roots of the teeth, in no instance was the mucosa lining the sinus found in direct contact with the root of a healthy tooth. In all normal cases a thin layer of compact bone is present between the roots of the teeth and the mucosa, but in some instances where there has been abscess formation at the root of a tooth, this intervening plate of bone may be destroyed, thus allowing the root to project into the sinus cavity in direct contact with the overlying mucosa.

Besides the recesses produced by the irregularities on the alveolar surface (Fig. 20), pockets may be formed by osseous projections on the anterior, or less frequently, on the posterior wall. Such ridges may, in rare instances, extend sufficiently far toward the central portion of the sinus as to form incomplete septa or septulæ. Such formations have no embryologic significance and are entirely due to irregularities in the process of resorption. Ridges and folds of any of these varieties probably assume an important role only in the presence of suppurative conditions within the sinus, when the recesses or pockets make the thorough cleansing of the cavity more difficult.

Changes in the facial bones in old age are those incident to the loss of teeth and the absorption of the alveolar processes, and the general thinning of the bone Fig. 11). The angle of the mandible also becomes more obtuse, sometimes to an extent suggestive of its original form in infancy.

BIBLIOGRAPHY.

Bardeen, Charles R.: Development of the Skeleton and of the Connective Tissues, Manual of Human Embryology, Keibel and Mall, 1910, i.

Callender, G. W.: The Formation and Early Groth of the Bones of the Human Face, Trans. Royal Soc. of London, 1870, clix.

Cryer, M. H.: Some Variations in the Frontal Sinuses, Jour. Am. Med. Assn., January, 1907, xlviii.

Cunningham, D. J.: Textbook of Anatomy, 1905.

Froriep, A.: Entwicklungsgeschichte des Kopfes, Ergebnisse der Anat. und Entwicklungsgeschichte, 1894, iii.

Heymann: Handbuch der Laryngologie und Rhinologie, 1900.

Killian. G.: Zur Anatomie der Nase menschlicher Embryonen, Arch. f. Laryngologie, 1895-96, ii, iii, iv; Der Nebenhöhle der Nase in ihren Lágebeziehungen zu Nachbarorganen, Jena, 1902.

Kollman, J.: Entwicklungsgeschichte des Menschen, Jena, 1898.

Mall, F. P.: On Ossification Centers in Human Embryos, Am. Jour. Anat., 1906, v.

Morris: Human Anatomy, 1914.

Ónodi, A.: Die Nasenhöhle und ihre Nebenhöhle, Vienna, 1893; Die Nebenhöhlen der Nase beim Kinde, Würzburg, 1911.

Schaeffer, Jacob Parsons: The Sinus Maxillaris and Its Relations in the Embryo, Child, and Adult Man, Am. Jour. Anat., 1910, x, No. 2; On the Genesis of Air Cells in the Conchæ Nasales, Anat. Rec., 1910, iv, No. 4; The Lateral Wall of the Cavum Nasi in Man, with Especial Reference to the Various Developmental Stages, Jour. Morphology, 1910, xx, No. 4; The Genesis and Development of the Nasolacrimal Passages in Man, Am. Jour. Anat., 1912, xii, No. 1.

Sobotta-McMurrich: Atlas and Textbook of Human Anatomy, 1909.

Spalteholz: Hand-Atlas of Human Aanatomy, 1069.

Zuckerkandl, C.: Zur Anatomie und Entwicklungsgeschichte der Nasoethmoidalregion, Med. Jahrb. Herausg. v. d. k., Gesellsch. d. Aerzte, Vienna, 1878; Normale und pathologische Anatomie der Nasenhöhle und ihrer pneumatischen Anhänge, Vienna, 1882, i; Die Entwicklung des Siebbeins, 6. Verhandlg. d. Anat. Gesellschaft (Vienna), Anat. Anz., 1892, vii; Anatomie der Nasenhöhle, Vienna, 1902, i.

DISCUSSION.

Dr. Cryer.—Mr. President and Members of the American Society of Orthodontists: I do not know when I have listened to a Paper from beginning to end in which I have been so interested as in this one by Dr. Davis. You all know that I have been working along similar lines for twenty-five or thirty years. Many of my sections of bone you are acquainted with. The greater portion of Dr. Davis' paper is indiscussible. It is a matter of facts he has given us, and you can not discuss facts. Some of the variations he has shown us, for instance of the maxillary and sphenoidal sinus, also the double osteum maxillare, are found in the specimens he has made. If our friend here, the President of this Society, had another lot of bones and was looking for variations, he would probably get other types. If I should drop all I have ever done and take up another lot of bones, I would find still others, so it depends on the specimens that each investigator obtains.

I am going to ask you the privilege of showing a few slides. Many of them you are acquainted with. In a little book written nearly twenty years ago I mentioned there were no two sphenoid bones alike: that if you made a complete picture of one thousand of these bones, the composite would be accepted as the typical sphenoid, but I doubt if you could find one. I also said that not only do variations exist in different skulls, but in the same skull the maxillary sinus on one side would be different from that sinus on the other side. Adami has gone even further than that and says there are no two cells alike.

The following slides are made from actual photographs. The nasal conchæ, turbinate scrolls, are well described by Dr. Davis. He gives certain variations as to the number of the concha, consequently the number of the meati will vary accordingly. Zuckerkandl stated that 6.7 per cent of the skulls examined by him had four meati. In skulls I examined I found as high as 60 per cent with four meati, some even had five, while one had six.

Slide 1—Two photographs showing relative sizes, photographed on the same plate. They show the outer walls of the nasal cavities, giving the variation, size and shape of the concha, consequently the shape and number of the meati as described by Dr. Davis.

Dr. Davis showed very nicely a developing vomer with two, right and left parts. Slide 2 is an x-ray picture of an adult skull, it plainly shows the two, right and left plates of the vomer with the space between them. This space between the plates of the vomer might, a few years ago, have been taken for an open (?) intermaxillary suture.

Dr. Davis divides the ethmoid cells into two groups, anterior and posterior. I have preferred to divide them into three groups, anterior, middle, and posterior; the anterior ones being anterior to the passage way from the frontal sinus into the middle meati; the middle being those belonging to the bulla ethmoidalis, with outlets into the hiatus semilunaris; while the posterior are grouped further back, having outlets into the third meatus of the nasal cavity.

Slide 3 shows the outer wall of the nasal cavity of a fairly typical skull with portions of the conchæ turned up, it gives a good idea of the anterior, middle and posterior ethmoid cells, also the sphenoidal sinus.

Slides 4 and 5 give an idea of the great number of variation of the frontal sinuses.

Slide 6: Dr. Davis states that the sphenoidal sinus shows more variation than any of the other accessory sinuses. It is certainly very irregular in shape and size but I hardly think more so than the frontal. This slide gives a good idea of the position, extent, depth and divisions of a rather typical sphenoidal sinus.

Slide 7 shows two pictures a very irregular and large sphenoidal sinus, extending forward to the cribriform plate of the ethmoid bone and including it, also extending into the anterior clinoid process and around into the pterygoid plates. There is a difference of opinion as to one sinus opening into another. I will cite one case as an example. The maxillary sinus had been treated for empyemia and supposed to be cured, but one day I observed pus right there (indicating) and passed a sound backward and inward into the sphenoidal sinus. Dr. Davis stated that the maxillary sinus is the most constant of the nasal accessory sinuses and that the extent of its development is most regular. In my experience both with the living subject and in specimens, I find it is not constant or regular by any means. The slide just shown (No. 7) shows also small irregular maxillary sinus.

Slide 8 is a horizontal section, showing a wide nasal cavity, no maxillary sinus on the right side and a small one on the left side.

Slide 9 is a photograph of two specimens, the picture on the left shows two very large maxillary sinuses extending well over the roof of the mouth compressing the nasal

cavities very much, there would be very little difficulty in finding a place to open into these sinuses, the picture on the right is very different, showing a wide nasal cavity, extending outwardly to the outer wall of the maxilla, in this case in opening the maxillary sinus a careless operator might drill into the nose instead of the sinus.

Slide 10 shows a very large maxillary sinus with the sphenoidal sinus extending outward to the line of the molar teeth.

Slide 11 shows an entirely different character of maxillary sinus.

It also shows an enlargement of the cell in the orbital process of the palate bone, the outlet of this cell is into the third meati of the nasal cavity.

Slide 12 shows a peculiar and very small maxillary sinus. At first one is inclined to classify it as a double maxillary sinus with a complete septum, but such is not the case, the posterior cell is an enlargement of the cell of the orbital process of the palate bone with its outlet normal into the third meati of the nasal cavity.

Slide 13 gives a good idea of the relation of the maxillary sinus to the various surrounding structures such as the teeth, zygomatic bone, and nasal cavity, etc., in a child about the time of birth.

Dr. Davis speaks of the relations of the teeth to the sinuses. This varies with age and race. Slide 14, familiar to most of you, represents a transverse section of a typical Caucasian face, it shows the roots of the molar teeth well up in the walls of the sinus and the sinus extending below the apex of the roots of the molar teeth.

Slide 15 is a fairly good typical transverse section of the face of a negro, its teeth do not extend into the wall of the sinus because of the more cancellated tissue between them and the sinus.

Dr. Davis says: "Beside the recesses produced by the irregularities of the alveolar surface, pockets may be formed by osseous projections on the anterior or less frequently on the posterior wall. One of these "pockets' is formed so frequently that I venture to name it the infraorbital cell or sinus, the outlets are always into the maxillary sinus, the position of the infraorbital tube or canal has considerable to do with the formation of this cell.

Slide 16 from an x-ray picture of a section of a dried skull shows a well-marked infraorbital cell, on the inner side of the infraorbital canal.

Slide 17 shows another cell of this character on the outer side of the infraorbital canal.

Slide 18 is still another one. It will be observed that in the left picture the grooves are shown in the outer wall of the maxillary sinus for the accommodation of the alveolar vessels and nerves associated with the maxillary teeth which include the molars, premolars, and the canines—not the incisors.

Slide 19 shows an interior and posterior view of a section cut in the region of the premolar and first molar teeth. It will be noticed that the maxillary sinuses are small and somewhat pear-shaped. The right frontal sinus is seen to be very large, extending downwards to a point below the level of the center of the orbit, in close communication with the maxillary sinus and the nasal lacrymal duct.

Slide 20 shows the largest maxillary sinus I have examined and measured, the two sinuses holding 70 c.c. It will be noticed that they came within 19 mm. of each other in the region where the section is made, but more anteriorly, they are only 13 mm. apart, it will also be noticed that the floor of the maxillary sinus is much below that of the nasal cavity. The central incisors must be in close relation to the floor of the sinuses as the two sinuses approximate within 13 mm. of each other while the width of the two central incisors is 18 mm.

Dr. Burke.—I would like to ask for some information from Dr. Cryer or Dr. Davis: In widening the upper arch where there is a very narrow restriction, do you lower the dome of the arch as a result of widening the distance between the upper molars on either side?

Dr. Davis.—I have not had a chance for observation on that, and am not in a position to answer. I think Dr. Cryer, having seen that work, could answer, and I defer to his opinion.

Dr. Cryer.—In regard to the last picture on the screen, I do not believe it is possible to "lower the dome of the arch by widening the distance between the upper molars" as has been asked. You would have to take your measurement in the upper portion of the nasal cavity, down to the cribriform bone—to the teeth or alveolar process; that would be the

measurement. You might lower it in certain conditions by cutting off the teeth and alveolar process.

You would not increase the depth of the nasal cavity. It would stay exactly where it is, and I do not think the spreading of the temporary structure would change either the width or the height of the nasal cavity. I used to fight Dr. Ottolengui on that point, and I would like him to answer it right here,—as to his opinion as to lowering the arch of the floor of the nose by widening the dental arch.

Dr. Ottolengui.—There is just as much chance to lower the roof of this house by taking the partition out of the dining room.

Dr. Carl Case.—I have been much interested in certain statements brought out by Dr. Davis' paper and in the discussion because there is a certain man in my home town—an oral surgeon who is quite widely known—who has made the claim that the widening of the dental arch has lowered the dome in several of his cases and he can substantiate his claim with definite proof in the form of plaster casts and measurements. I have discussed the possibilities of such a result on several occasions and have refused to believe in it.

Dr. Ottolengui.—That was a kind of flippant answer, and I should not have made it. Most men who make that claim forget all about Dr. Cryer's pictures, and depend on plaster casts for evidence. They cut a section in the back of the plaster cast and move the teeth out, and measure that, and show they have lowered this just so much, whereas they have changed this whole shape (indicating). They forget that is not the shape of the roof of the mouth at all. On top of that is the septum and then the two walls. You can not pull that down.

Dr. Dewey.—I thought this discussion was on Dr. Davis' paper, and see it has resolved itself into the question of opening the intermaxillary suture and lowering the roof of the mouth. We have conclusive proof that the floor of the nose can be lowered, or that it does lower. If you will remember the pictures which so beautifully illustrated the development of the nasal septum, it has a beginning at the horizontal plate of the ethmoid, forming as a cartilaginous structure, etc. You have developed on the sides, plates of intramembranous bone. You have the nasal septum coming down from above as a structure belonging to the chondrocranium. The nasal septum will develop and not be influenced by conditions which influence the development of the superior maxilla. Structures laid down first are influenced last in the process of evolution. Structures laid down last are influenced first. The palatal bones are of late origin. In some animals the vomer projects down between the superior maxillæ and carries teeth. It will not be affected by conditions which affect the superior maxillary. In certain conditions of development the superior maxillary fails to develop as it should.

As a result of failure of development in growth, we have a deflected septum. We have conclusive evidence in those cases examined by competent rhinologists who have made measurements who have claimed those nasal cavities have been one-half to three-quarters their proper size. As a result of orthodontic treatment, the floor of the nose has been lowered, and the nasal septum has straightened out.

If you can tell me by any known means, how you can straighten that septum without an operation, except to lower the floor of the nose I should like to know it. You may say orthodontic treatment did not lower the floor of the nose, but the floor of the nose became lower during the orthodontic treatment. The fact is, you increase the space between the roof of the mouth and the roof of the nasal cavity. As you widen the dental arch, the curve increases, and measuring dentally, from the teeth to the roof of the mouth, the distance may be greater. But the roof is lower, compared to the ethmoid bone, than it was before. I can bring evidence, not only from my practice, but from other men, that the nasal septum does straighten out. We can prove that the suture may be opened, but we do not gain anything by it. The floor of the nose will come down whether it is brought down or it grows down.

Dr. Ottolengui.—Mr. President, I do not agree with one thing Dr. Dewey has said, and he does not disprove what I say. The proposition which the majority of orthodontists put up to their local rhinologists is, they can do this thing by mechanical means, and consequently I was absolutely right in sticking for mechanical means. You can not do it mechanically. As a result of lack of nutrition, imperfect mastication of food, and changing the whole metabolism of the individual, and by giving him a correct masticating apparatus you may have a resumption of normal growth, and a deepening or lengthening

or widening of the sinuses of the head. It is the result of improved metabolism and not a result of mechanical treatment. I have never denied these improved conditions may occur. The evidence of the rhinologist is not final, because the rest of the child has been growing. If measurements could have been taken from the top of the nose to the top of the chin it will be found that has increased also. Where you find excessive growth in that bone you will find a general increase in the size and growth of the whole individual, and it does make a difference when we say it makes no difference whether it comes down or grows down, and we should say that if we succeed in establishing correct metabolism, etc., we may depend upon normal growth.

Dr. Dewey.—Dr. Ottolengui thinks he agrees with me, but he does not. While the face lengthens, this lengthening would never occur if the orthodontic treatment had not been given. The nasal septum straightens out through orthodontic treatment. The face is made normal. Normal cell metabolism is brought about. I still contend that the floor of the nose has been developed, or comes down by a process of development started by orthodontic treatment.

Dr. Kemple.—I have not known definitely of a single instance of the septum straightening during the process of orthodontic treatment, and I am delighted to have Dr. Dewey say he can submit evidences of several such cases. I almost feel we have another paper for the next meeting of this Society.

Dr. Dean.—I have a case of a little girl six years old. She had a deflected septum and was examined by a rhinologist. He made measurements before she was six years old, and thought he could help her. At seven years of age he said he had not done any good at all. I made impressions of the mouth, and the upper jaw was three-fourths inch narrower than the lower. We made radiographs and measurements of the nose, and the Doctor also made record of the septum. In seven months from the time the expansion arch was put on to widen the upper jaw, the septum had straightened. The roof of the mouth (or floor of the nose) in the x-ray plates, was much thinner. Whether the bone stretched or not, I am not in position to say. The septum has straightened out and the floor of the nose had lowered, according to his measurements.

Dr. Weinberger.—I would like to ask the essayist whether generally, in full term fetal skulls, he has observed the presence of maxillary sinuses? In one slide he showed the sinus present, in the remaining slides I failed to observe them. The essayist showed as typical normal fetal skulls, skulls with the mandible either in protrusion or retrusion. I would like to take, at this time, the opportunity of stating, before reading my paper, that the textbooks showing these conditions and labeled "normal" are in error. If it is the experience of Dr. Davis that the skulls at full term either have a protruding or retruding mandible then those cases must be considered as abnormal.

Dr. Davis.—The numerous lantern-slide illustrations shown by Dr. Cryer serve to further show that definite conclusions can not be based on a few anatomic observations. As a medical student I did prosecting for Professor Spitzka and Professor McClelland, and was impressed by the frequency with which dissections of the accessory sinus areas showed types of development not in accord with the usual textbook descriptions. A few years later, as the Corinna Borden Keen Research Fellow, I resumed work along this line, studying the development from early fetal life to maturity. Most of the illustrations used in this paper are from dissections made at that time. Most of Dr. Cryer's illustrations are from middle-aged and aged specimens, which accounts for some of the differences in our specimens, also our difference in observations regarding the protrusion of the roots of molar teeth into the maxillary sinus.

In reply to Dr. Cryer's question as to whether one of his specimens should be classed as having a large single frontal sinus or as two sinuses in which the intervening wall had been resorbed or destroyed, I would classify the sinus as a single one, because it has only one ostium. Should the wall between two sinuses be destroyed the communication with the anterior ethmoidal area on each side would still persist.

Supernumerary frontal sinuses occur in probably three or four per cent of cases,—certainly a large enough percentage to show that anyone doing operative work in this area should not operate until an x-ray examination has been made. For, without such examination in a supernumerary frontal sinus case, should an opening be made into the medial sinus, there would be no definite way of telling whether going further laterally would open into another frontal sinus or into the cranial cavity.

Regarding the classification of ethmoidal cells, Dr. Cryer and I describe the same anatomic condition but use a somewhat different classification. He prefers the classification as anterior, middle, and posterior, while I prefer the classification as anterior and posterior, including the middle cells as a subdivision of the anterior group.

Cells which develop in such a way as to occupy the space usually taken by the posterosuperior angle of the maxillary sinus are simply aberrant posterior ethmoidal cells. One of my illustrations and one of Dr. Cryer's show such development.

Dr. Cryer's illustrations, showing an infraorbital cell, look as if the cell developed as an irregularity in resorption during development of the maxillary sinus.

Cells which develop in the orbital process of the palate bone are usually extensions from a posterior ethmoidal cell, rarely from the anterosuperior portion of the sphenoidal sinus.

My specimens probably show about the same variations in the level of the floor of the maxillary sinus as do Dr. Cryer's. The figures which I gave are what I found the averages to be.

Pneumatization processes extending into the middle turbinates, as shown by one of Dr. Cryer's specimens, are not cysts, but are ethmoidal cells which may develop either from the anterior or the posterior group. Cells occasionally develop from the anterior ethmoidal area in such a way as to produce pneumatization of the crista galli.

I have not followed out minute dissections to show the nerve supply of the walls of the maxillary sinus and the formation of the plexus supplying the teeth, thus can not answer Dr. Cryer's question from my personal observations.

Dr. Cryer asked where the "Davis family" make openings into the maxillary sinus when treating suppurative processes. That depends on the type of involvement. In acute or subacute cases requiring irrigation, we usually puncture the wall in the inferior meatus —a small puncture which does not leave a permanent opening. In the chronic type with thickened or polypoid mucosa, we make the opening from the mouth cavity—above the premolars.

The question of the possibility of lowering the dome of the roof of the mouth, I am not in position to discuss, since I have not had opportunities to make clinical observations. However, it does seem to be a point which needs careful observation by a number of the men of the Society,—making measurements not only of the arch itself but also on other portions of the face, so that the general growth of the face may be used as a control. A summary of such observations would be of value.

In reply to the question regarding the size of the maxillary sinus at birth, I would state that like all accessory sinuses at any period of development, they show considerable variation. The majority show a distinct maxillary sinus at birth, but the extent of osseous development of the medial wall varies a good deal. The specimen shown is practically an average development of the sinus at birth.

The protrusion of the mandible in the illustration of an infant skull is, I think, more apparent than is real in a fresh specimen, because the removal of the soft tissues allows the mandible to be shoved further up than when the soft tissues covering the alveolar processes are intact.

I wish to thank you for your close attention and for your discussion. I happen to see on the table here an invitation from the Mayor of Philadelphia, asking the Society to meet there next year. If the invitation is accepted I shall be very glad to arrange a larger exhibit of specimens than I have here—these being only a few to show the type of dissections upon which my observations were based.

THE HISTORY OF ORTHODONTIA

(*Continued from page 474.*)

BY BERNARD WOLF WEINBERGER, D.D.S., NEW YORK CITY.

GEO T. BARKER, in the *Dental Cosmos,* Nov., 1862, page 178, on *The Treatment of Irregularities,* states:

"The first subject of consideration in the treatment of irregularity is to ascertain when and for whom to operate. The time to commence either surgical or mechanical treatment can be answered in a few words, i. e., that no effort for correction should be attempted previous to the eruption of the permanent teeth. This, as a general rule, should be adhered to, although there are exceptions; but they rarely occur. I would not, however, wish to be understood as including in this remark those irregularities which are the result of the nonabsorption of the fangs of the deciduous teeth, and which are easily overcome by the removal of the temporary ones. The question, for whom shall we operate? can not so readily be answered; but this is, of all subjects, the most important, and deserves the most extended observation.

"In the treatment of irregularity, I have adopted the following general rule: When a case presents, and the indications are that the proper time has arrived to make use of mechanical appliances, my practice is to first impress the parents or guardians with the importance and necessity of the operation; stating to them that they will be held responsible, to a great extent, for any neglect on the part of the child to wear whatever plate or agent that may be used; and it is well, in the outset, to state as near as may be what will be the trouble on the part of the operator, and what will be the probable charge; for parents can not appreciate the labor, time, and expense which the dentist must devote to accomplish a satisfactory result, unless told of it, and no method seems better calculated to awaken the earnest interest of parents than to state that to succeed you will probably have to devote so much time and outlay, and that you consider fifty or a hundred dollars but a moderate compensation for the value of a successful result. The above sum is mentioned not as a criterion of charges for others, nor, indeed, of my own; for I hold that a conscientious man will recognize in the satisfaction derived from a worthy action a payment which will go far toward compensating him for time and trouble. In these, as in most dental operations, no definite scale of charges can be adopted or adhered to. The child should next be addressed, and every effort should be made to impress upon the mind the importance of the operation, and the great necessity which exists for the establishment of perfect confidence between patient and operator. Disguise no facts as to pain and inconvenience, if a painful and long-continued operation is expected, tell him of it, and my experience is that the child will acquiesce, and will give you his confidence, will do as you desire, and, like the little patient for whom it is necessary to extract a deciduous tooth, and who comes to the office dragged by the parent, but assured that the removal of the tooth will positively give no

pain, if the operator, acquiescing in such deception, draws the tooth, confidence between the two can never be restored. If, on the other hand, he states to the little sufferer that the tooth must be removed, that it will give pain, but that he will be as gentle as possible, then it is that the child will read honesty in his countenance, his confidence is given, and he will submit to a painful operation ofttimes without a murmur. So it is with the patient who presents for the treatment of irregularity; honesty, if strictly observed, will insure a successful result, even in cases where repeated trials and subsequent failures have been made. I have repeatedly known young ladies, of delicate nervous organization, to wear plates that were positively painful, and, what was more, remove, expand, and replace them, themselves.

"Of the different appliances necessary to overcome irregularity, but little can be said in a communication like this; but one rule can be laid down, and that is, make use of the most simple plate that can be made to do the work required, and those are always the best that patients can remove, clean, and replace themselves.

"The cooperation of the will is no small value in the treatment of irregularity as physiologists agree that the two primary actions, viz., 'composition' and 'decomposition' of the force of nutrition are modified by the influence of the mind; therefore, when the patient throws the mind upon the operation and assists in the introduction of the appliance, a satisfactory result is more likely to be accomplished and in a much shorter space of time.

"Having, as suggested above, stated the inconveniences and the importance of the operation, and having gained the perfect confidence and mental assistance of the young lady, my efforts were then directed to the correction of the irregularity, my object being first to expand the arch and to create a natural articulation of the bicuspids and molars, leaving the anterior teeth to be treated at a subsequent period. To accomplish this result I used a simple silver plate struck up to fit the roof of the mouth, removing it at first every three days to expand, cleanse, and replace it. This simple appliance was first, I think, introduced to the notice of the profession by Dr. T. L. Buckingham, and it certainly is invaluable for the purpose of expanding the arch. It was. for the first few weeks, retained in the mouth by two silken ligatures, one around each of the bicuspids, but in a short time the patient would each day remove it herself, expand the plate and introduce it, requiring nothing to keep it in place, also wearing it constantly. In two months' time I had gained, by actual measurement, three-eighths of an inch in the width of the arch, measured from between the first bicuspids.

"Not being able to keep a silk ligature about these teeth to induce their more rapid presentation, silver thread, as used on guitar strings, was employed with complete success. In effecting so rapid a change in the general contour of the arch, it will be presumed that more or less inflammation of the peridental membranes and adjacent soft tissues has been induced; but such is not the case, either in this or in other instances where rapid changes of the arch have been accomplished. It is true that more or less inflammation will be induced, but it can usually be overcome by using as a lotion a solution of the chlorate of potassa,

in the proportion of one to two drachms of the salt to four ounces of the water. The following recipe has been employed with value:

℞	Potassae Chloras,	ʒij;
	Tinct. Catechu,	fʒiij;
	Eau de Cologne,	f℥j;
	Aqua,	f℥vi.
	Fiat Solutio.	

The mouth to be rinsed with a small portion of the solution several times during the day.

George T. Moffatt, in the same journal, January, 1863, page 297, in *Treatment of Irregularities,* says:

"I made a plate of the vulcanite material (the 26th of May), covering the palate and capping the upper bicuspid and molar teeth, and antagonizing with the under molars and bicuspids. To this plate, by means of screws, I attached a gold band, which passed anterior to the incisor teeth, and having two hooks which caught under the cutting edge of the central incisors; these hooks effectually prevented the band from slipping up (Fig. 1). My next operation was to insert be-

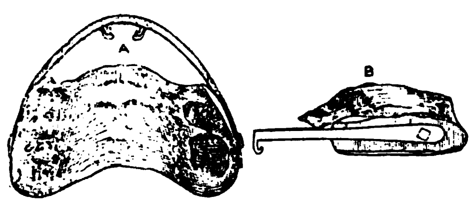


Fig. 1.

tween this band and the labial surfaces of the incisor teeth pieces of elastic caoutchouc, the operation of which was to press the teeth back. As the space between the band and the teeth increased, I either increased the thickness of the caoutchouc or shortened the band. I held the teeth in position until the thirteenth of September, when the appliance was removed."

H. Meredith White reported another case of *Irregularity* in the *Dental Cosmos,* 1863, page 472. "A plate was made for the upper jaw, with plain half bands for both bicuspids of each side; between the bands around the first and second bicuspids, and close to the situation between the necks of the teeth, there was placed on each side of the lingual surface of the plate a small ring, made out of a piece cut off the end of a spiral spring. To these rings were attached two spiral springs, one for each side; these converged and met in front immediately behind the space between the two central incisors, and were fastened to the shank of an anchor-shaped piece of gold. The shank was made flat, so as to fit easily between the centrals; the under surface filed out a little, so as to prevent undue pressure upon the gum; the pieces corresponding to the flukes of an anchor were flattened and hardened with a hammer, and were intended to rest against the labial surfaces of the central incisors. The springs attached to it were shortened from time to time, so as to keep up a continual pressure, drawing the teeth backward."

J. Foster Flagg in the *Transaction of the Odontographic Society of Pennsylvania, Dental Cosmos,* August, 1863, page 17, referring to those cases "caused by the protrusion of the inferior maxilla and consequently malocclusion of the teeth," says:

"For the correction of this form of irregularity, the ordinary practice has long been the adoption of a plate over the teeth of the lower jaw, upon which inclined planes were so arranged as, by occlusion with the upper teeth, these should be forced outwardly, and, at the same time, some backward movement of the lower teeth be effected by producing a certain amount of change in the angle of the inferior maxilla. The application of this force is dependent upon one of two causes; viz., the persistent efforts of the patients themselves in closing the teeth

Fig. 2—J. Foster Flagg.

upon the planes, or by means of pressure with elastic bands arranged over the head and under the chin, after the manner of the Fox bandage, for preventing luxation during extraction. By means of these appliances, the corrections of very bad cases of this irregularity are sometimes effected in astonishingly short periods of time; but, on the contrary, it is not infrequently the case that month after month passes by without any manifestation of progress.

"Children will so protrude the lower jaw as to bite behind incredibly long planes, and, upon the least accession of tenderness, they will only eat such soft food as can be manipulated with the tongue, and never touch the planes at all. They will also complain of the hurting of the strap, and parents would rather discontinue its use than have their own or the childrens' rest disturbed, and thus the dentist accomplishes—a failure!

"Now this conclusion may seem unjust, and yet there is much truth in it, for I think that in the correction of irregularities all apparatus should be self-acting—so constructed as to require no cooperation on the part of patients, and, moreover, so arranged as to prevent the possibility of their interference with its workings. In consequence of these views, I have, for several years, abandoned entirely the use of inclined planes, and have substituted for them, in correcting cases of the kind under consideration, a combination of wire, ligatures, and gutta-percha, which arrangement I can much more clearly elucidate by means of models than by description.

"The first model represents inclined planes which had been adjusted upon the teeth of this patient, and worn for a period of one year. From want of cooperation upon the young lady's part, and from disinclination to bite upon tender teeth, no result was obtained.

"Model 2. Front view showing gold wire adjusted to upper teeth, silk ligatures thrown around lower teeth, and gutta-percha guard, to prevent occlusion,

Fig. 3

Fig. 4.

moulded upon left lower molars and bicuspid. The wire was secured by ligatures to the four superior bicuspids, and one central was gently brought forward by silk. After it touched the wire, it was firmly attached and thus having gained strong points at either end and in the center of the wire, the remaining teeth were brought into position with much ease and rapidity.

"Models 3 and 4. Inside views of both jaws, showing attachments to wire upon upper teeth, and the apparatus which was used for drawing the lower teeth in. Silk ligatures were thrown around the twelfth year molars, (both sixth year lower teeth had been extracted by the gentlemen who had employed the inclined planes with the view of insuring the correction.) India rubber rings (from tubing) were secured to these teeth, and attached together by a short double silk ligature; silk was then passed around the lower front teeth, and the two rings stretched, as is very clearly demonstrated in Model 4. (Figs. 3 and 4.)

"It seems to me that every argument which could be adduced would favor the treatment which I here suggest, and that no arguments tending to oppose it can be presented which would have weight either with unbiased practitioners, or, what is of quite as much importance, the patients themselves. I, therefore, shall briefly

consider (and illustrate by models) the possibility of great advance toward, and sometimes entire completion of, the correction of the irregularity under discussion, simply by due attention to the deciduous teeth and the application of an occasional ligature.

"The fact of the more frequent presentation of the lower permanent teeth posteriorly to the deciduous is probably known to all of you, and it is my practice, both by teachings and ligatures, to prevent any attempts on the part of parents which shall result in removing or even loosening the deciduous teeth, so long as it is possible to retain them with any comfort to the patient. By this means the inward inclination given to the inferior permanent centrals is so great as to frequently insure their position under the superior centrals, and if it is indicated, by the presentation of the superior centrals in the rear of the superior deciduous centrals, that this will not be accomplished, I at once remove the superior deciduous centrals and direct pressure to be made with the thumb on the palatine faces of the permanent centrals. The position assumed by the thumb is such as will at the same time naturally press upon the labial faces of the lower teeth, and thus a good result is almost always effected.

"I regard the accomplishment of a natural occlusion between the centrals as more than half the battle gained, for it will readily be seen by examining the dental preparations of subjects under six years of age, that the position of the forming teeth is such as will indicate their being governed, to a very great extent, both as regards eruption and location, by the proper or improper placing of the anterior teeth, for the laterals are formed posterior to the centrals in the inferior jaw, and the anterior to the centrals in the superior jaw."

Dr. Fitch described a case in which he expanded and protruded the front teeth by means of bars and screws, an apparatus consuming considerable time in its construction, and believed that the same result might be obtained by means much less intricate and troublesome. He dwelt upon the importance of permanently ligating teeth after the correction of irregularities, sufficiently long to insure a deposition and organization of new tissue for their retention. He thought that many dentists did not recognize the direction in which the permanent teeth should present in relation to the temporary ones. This knowledge he regarded as indispensable to success in preventing and correcting dental deformities.

J. H. McQuillen before the same society, in discussing Dr. Flagg's paper, says:

"As no remarks have been made with regard to the cause or causes of irregularities, he would take occasion to direct attention to four prominent causes. 1. Hereditary predisposition. 2. Bad habits. 3. Accidents. 4. Premature extraction.

"1. *Hereditary Predisposition.*—The opportunities frequently afforded of observing the contracted jaws, or the disproportion between the superior and inferior maxilla running through families, passing from parents to children, were not only interesting as subjects of study, but also suggested that, where such predispositions were known to exist, the proper remedial treatment might be commenced at a sufficiently early period to obviate the difficulty; and it was pos-

sible that, by continuing this care, in the course of one or two generations the predisposition might be broken up.

"2. *Bad Habits.*—A common practice among infants after weaning, and frequently continued for years afterward, of sucking their thumbs, was a prolific cause of that form of irregularity in which the superior incisors bulge forward and rest upon the lower lip. The disposition on the part of parents to permit their children to indulge a preference for soft food, almost to the entire exclusion of everything that requires a decided effort in mastication, (as instanced in the rejection of crusts of bread, etc.), was also highly reprehensible. The force demanded and the shock attendant upon the mastication of hard food was of decided advantage in enlarging and expanding the maxilla. The attention of parents should be directed to these facts.

"3. *Accidents.*—Under this head might be included the various casualties which children are liable to from falls, or being struck by balls, bats, etc., in which premature loss of the deciduous teeth is followed by a contracted arch.

"4. *Premature Extraction.*—Of this it was not necessary to say more than that the impropriety of such procedure is not only universally recognized by the profession, but the general intelligence of the people on this point is becoming more and more extended."

E. Ware Sylvester on *Abnormal Development of the Teeth, Dental Cosmos,* page 58, 1863, read before the *American Dental Convention,* says:

"When the architect designs to erect an edifice which shall not only be ornamental, but a lasting monument to his name, he is extremely careful to excavate deep and lay the foundation beyond all chances of disturbance, in order that the edifice in all coming time may remain unchanged and unchangeable. So the physiologist, if he would build a theory which shall stand the test of the most thorough scrutiny and investigation, must 'begin at the beginning,' and having so commenced, the causes of the disturbance in Nature's laws can be often plainly discerned.

"We come to the conclusion that the full dental arch and sound teeth are natural according to the designs of the Creator, and that a contracted arch and diseased teeth are the results of a series of violations of Nature's laws.

"1. Parental Influence.—'Like begets like.' 'As is the father so is the son.' These are truisms which have long since passed into proverbs, and are generally admitted. If both parents have well-developed mouths, and the child is reared in accordance with Nature's laws, it will have similar masticators. If one of the parents has a defective dental apparatus and the other perfect, some of the children will inherit the 'like' of the one, and some of the other, and often the two mouths will seem to be blended in the offspring. We suppose that all have seen cases like the following. The mother's mouth articulated in the usual manner, the upper incisors closing in front of the under; the father's antagonizing perpendicularly. Now it often occurs that the children of these parents will seem to have the right side of the mouth resembling the one parent and the left resembling the other. From the median line as a point, the two sides of the mouth are dissimilar, forming a difficult case to regulate and put in perfect shape.

"Defective teeth on the part of one or both parents seem to follow the same law that 'like produces like.'

"2. Gestatory Influence.

"3. Improper Diet.

"4. Impure Air.

"5. Want of Exercise."

Geo. Langsdorff published in 1863, *Praktische Anweisung für die Regulirung der Zähne,* a pamphlet I have been unable to obtain. Pfaff says, "he devoted himself mainly to the psychological conditions of the various 'methods' of irregularities and their causes." Among the methods he mentions false articulation, which is possible when one, several, or all of the upper incisors articulate behind the lowers, or when a tooth stands partly or entirely out of the proper range of teeth.

M. S. Cartwright read before the May meeting, 1864, of the *Odontological Society, Great Britain,* a paper entitled *Reflections on the Cause and Treatment of Some Forms of Irregularity:*

"Irregularity in the position of teeth in the human subject is the result of a departure from the normal type, in a greater or less degree, as regards the form and capacities of the jaws. The teeth are always normal as to size—that is to say—there is no evidence of teeth having at all degenerated in external forms and general proportions, when compared with old, and even teeth of considerable antiquity; but the old sculls which are brought to light, and oftentimes in some numbers, generally exhibit full capacity in the maxillæ. It may, therefore, be fairly assumed that irregularity—although expressed by—does not depend so much upon the teeth, as it does upon the absence of proportionate development in the maxillæ, and consequent want of space in the bones of the jaws which may be defined as the true cause of irregularity in the position of the teeth in the majority of instances.

"There are two forms of irregularity of the lower jaw, in which the circle of the teeth is larger than in the upper jaw, but in the one form the irregularity is dependent on the front teeth; in the other it arises from congenital abnormal size of the whole of the inferior maxilla, though both present what is termed underhung jaws.

"But in the first example—and what may be termed the false underhung—the front teeth from some cause or habit occurring during the eruptive stage, probably playing with the upper teeth, and so gradually, as the teeth extrude, getting a false bite, the lower jaw being brought abnormally forward, the habit arising mostly from the molars having been lost at an early period, whereby the pressure, on closure of the jaws, is brought directly on the front teeth, and an inclination is given to glide the lower over the upper teeth; but there is no irregularity in the form of the superior maxilla, and often but little inclination inwards of the teeth, although in some cases the front of the alveolar portion of the bone is flattened, and the teeth inverted. The molar teeth and bicuspids in these cases often antagonize normally.

"In the second example the whole range of teeth, as well as the jaw itself, is larger and wider than the superior maxilla; the inner cusps of the molars and

bicuspids of the lower jaw being received between the cusps of the antagonizing teeth of the upper jaw and the canines and front teeth biting freely forward, and in front of the upper incisors and canines.

"The former condition then is fortuitous, and is amenable to mechanical treatment; the latter is hereditary or congenital, and can not be remedied."

"Another form, not so frequently met with, is when the teeth in front of the mouth do not meet, but the back teeth come in too close and too early contact. Now this unsightly and unsatisfactory class of irregularity is dependent on the form of the jaws, the teeth are generally regular and as far as the arches go, they are well developed. The cases are sometimes congenital, but certainly not always, and seldom if ever hereditary: at least, I can not call to mind a case of the parent being so circumstanced; nor have I seen the deformity transmitted to the children by the parent whose mouth presents this form of malformation.

"The receding chin is a marked feature in these cases, and the opposing surfaces of the alveoli with the teeth present convexities.

"Next there are the various degrees of contracted jaws. Some really congenital, with the compressed sides and deep palate, and often presenting regular, but projecting anterior dentures; others hereditary, and some manifestly dependent on the pressure of crowded teeth.

And lastly, the angular jaw confined like the last to the upper maxillæ and teeth, in which the width is great between the molars, and which answers to the base of a triangle; but the incisors are angularly placed, and which answers to the apex of a triangle, and the distance between the apex and the base is comparatively less than we find to be the case in well-developed jaws. These forms assume the hereditary, the congenital and the mechanical types.

"I have enumerated four principal forms of jaws which favor irregularity in the position of teeth, and they comprise the hereditary, the congenital, and the mechanical types.

"Hereditary irregularity applies to transmitted peculiarities as regards the conformation of the jaws, and also to transmitted irregularity of particular teeth—absence of certain teeth, or the presence of supernumerary organs.

"Congenital malformations of the maxillæ are abnormal forms, *per se,* and occur usually without any hereditary predisposition, although in some forms they prove to be hereditary.

"Mechanical irregularity is not so much dependent on the form of the jaws as it is on the position of certain teeth, whereby obstruction to due placement is produced by interlocking or misapplied apposition.

"Practical deduction then inclines one to the conviction that temporary teeth have no part in preserving the form of the jaw, and that their removal does not in the least interfere with its due development and growth. They have their special mission, which they properly fulfill under favorable circumstances, during the developmental increase of the jaws of early childhood.

"The second denture growing within their crypts plays the important part of aiding the developmental features of the alveolar portions of the maxillæ, and has doubtless the principal share in determining the forms of the arches of the jaws; and, with the exception of the forward position of the anterior permanent

molars, when the temporary posterior molars have been early removed, no ill effects that I have seen, as far as the second denture is concerned, result from the removal of first teeth.

"The mechanical treatment of irregularity has very much increased of late, but I purposely confine my observations to that particular treatment which ignores the propriety of removing teeth, and insists on developing the alveolar arches by pressing crowded teeth into a regular circle. It is better practice, and more conducive to the welfare and comfort of the patient, I will say—taking the past, the present, and the future into consideration—to deal with small jaws and irregular teeth by mechanical means, or to prevent irregularity by the timely and shorter treatment of removing certain teeth, in order to make room for the harmonious placement of the rest."

Thomas Ballard, on the Constitutional Ill-Effects of Fruitless Sucking, and the Diagnostic Value of Deformed Jaws in Relation Thereto, read before the *Odontological Society, Great Britain,* page 147, *Transactions,* 1864, states the following:

"If an infant be exposed to fruitless sucking, which it may in various ways, the dangers which beset it are numerous and most serious. Tracing them briefly from birth, they are, primarily and principally, the green purging, with its attendant abdominal pain, which, with the sore mouth, constitutes thrush, a disease proverbially prevalent very soon after birth.

"Should the infant escape death in any of the above-named shapes in the first few weeks, and the state of diarrhea persist, then hydrocephalus is sure to supervene; and under this head I include all the various forms of convulsive and paralytic diseases to which children are liable, as I believe them all to be mere modifications of degree of the one common defect; viz., imperfect growth of the brain consequent upon defective nutrition, which necessarily results from partial destruction of the tissues of the stomach in the mode previously described. Thousands of children die annually of these diseases; but many sufferers escape death, and they constitute the various defective individuals with which all classes of society abound. The worst form is the idiot, and in this class there are many degrees; besides, there are the rickety, the phthisical, the ill-grown, and those who are simply weak and delicate.

"It is objected against my views that I attribute too much to the ill-effects of fruitless sucking; but I urge attention to the subject of the deformities of the teeth and jaws in support of my doctrine. I hold that the deformities to which I refer, some of which are exemplified by the models on the table, are produced solely by the retained habits of sucking; and it is the children who have been exposed to fruitless sucking and consequent persistent diarrhea, with its attendant evils, when infants, who acquire the retained habits of sucking, and thus get their jaws deformed. And as in idiots are seen the worst forms of defective growth, so also do they exhibit the most aggravated forms of deformed jaws and teeth, the habits of sucking being retained by them to an advanced age. This statement can easily be verified by anyone sufficiently interested in the subject to be induced to visit one of the asylums devoted to the reception of these unfortunate individuals. So also are the deformed jaws and teeth com-

monly to be observed among the ill-grown, the phthisical, and the weak and delicate members of society. The normal jaw with well-set and perfect incisor teeth, is the principal characteristic feature of an individual possessing a sound constitution.

"The various sources of fruitless sucking to which infants are commonly exposed are as follows:

"a. Being put to the breast before the milk is secreted, i. e., before sixty hours have elapsed after delivery.

"b. Being allowed to suck long at a breast which does not yield as much milk as the infant requires.

"c. Being fed from a bottle fitted with a calf's teat, a piece of wash-leather or parchment, or a long-used india rubber teat.

"d. Or being supplied with a sugar teat (the Zupel or Zulp of the Germans), which consists of some moistened bread and sugar tied up in a rag, and is given to the child to suck in order to keep it quiet. Some monthly nurses have the custom of constantly using this, and when they take the child up from its bed, the sugar teat is taken from its mouth and slipped into the nurse's pocket.

"It will also be certain to acquire a 'retained habit of sucking' either some portion of its hand or tongue, and then will eventually acquire a deformity of the jaw, which will bear some sort of proportion to the extent of injury which the child has sustained by the habit.

"Before I conclude I am desirous to direct your attention to another defect of the teeth resulting from fruitless sucking. The irritation of the gums which is set up by the constant friction interferes prejudicially with the growth of the incisor teeth.

"So in reference to the permanent incisor teeth, I believe the serrated and honeycombed varieties are the result of some form of fruitless sucking during the first three years of life. To illustrate this, I have two brothers: one was fed by a bottle, and acquired a retained habit of sucking the blanket, and he has serrated incisors; the other was spoon-fed, did not acquire a retained habit of sucking, and his incisors are perfect.

"The points then I am desirous to see recognized are, that the serrated and honeycombed incisor teeth, as well as the peculiar projections of the jaws, which result from the various forms of tongue- and hand-sucking, are evidences that the individual has been exposed when a child to the prejudicial influences of fruitless sucking, and that the various degrees of weakness and delicacy usually exhibited by such persons are not the result of any hereditary disease transmitted by the parents, but an acquired state, the consequence of having been exposed to the evils in question."

G. M. Humphrey in the *British Journal of Dental Science*, 1864, page 447, speaking on *The Growth of the Jaws*, says:

"Analogy leads us to suppose that the enlargement of the jaw bones is effected, and their proper shape is given and preserved, mainly or entirely, by addition at some parts and subtraction at others, there being little or no interstitial growth; and the disposition of the teeth and changes which take place during second dentition, as well as the position of the additional teeth of the second

series, and a comparison of the arch of the lower jaw at different periods of life, are confirmatory of that view.

"In the lower jaw the five anterior teeth, on either side, are formed below and behind the five deciduous teeth—the two permanent incisors beneath the two deciduous incisors, the permanent canines beneath the deciduous canines, and the bicuspids beneath the deciduous molars. As they ascend they advance a little forwards into the places of the deciduous teeth. The permanent incisors and canines, being larger than their predecessors, occupy rather more space, and extend a little beyond the range of the deciduous canines, so that the permanent canines encroach somewhat upon the territory of the deciduous molars. This is, however, compensated for, and room is afforded, by the size of the bicuspids not quite equalling that of the deciduous molars. The third molars of the child, which are also the anterior molars of the permanent series, and which are formed immediately behind the hinder deciduous molars, retain their position throughout life, and the alveolar arch between them, in which the ten deciduous teeth and their ten successors are placed, undergoes very little alteration of size or shape after birth. Even while the two halves of the jaw remain separate there is very little growth at the symphysis; and after they are anchylosed, which takes place between the sixth and ninth month after birth, the growth at this part seems to be entirely arrested.

"The fact is the part of the arch of the jaw which is first formed; viz., the part intermediate between the alveolar and the lower edges, retains its original curve, undergoing no alteration of form; but as the bone increases upwards and downwards the new part is, in each direction, and more especially below, thrown a little outwards, that is, into a wider curve. Slight additional space is thus afforded for the teeth, and a convex vertical outline is given to the hinder surface of the jaw. In the European jaw the projection of the alveolar part is very slight, that part and the teeth being nearly vertical, whereas the lower or mental edge is thrown out considerably, giving a marked prominence to the chin. In the Negro the mental projection is less, and the alveolar projection is greater; and in the monkey and other inferior animals the alveoli become thrown out into an arch extending far beyond the range of the jaw at birth, but the chin remains suppressed to its original curve or nearly so.

In the upper jaw, the relations of the several primary teeth and their successors to one another is the same as in the lower jaw; but the enlargement of the alveolar arch by extension outwards, during its outward growth, is somewhat more marked. Hence the alveoli and the teeth acquire a more oblique direction; and hence the incisors and canines project in front of their opponents in the lower jaw, so as to admit the cutting edges of the lower incisors to be drawn up, scissor-like, behind the edges of the upper incisors, when the jaws are approximated.

"The additional teeth of the second dentition (the two hinder molars on each side) are placed behind those of the first dentition, in a line which is a continuation of the alveolar line of the infant. This is shown by placing an infantile jaw upon an adult jaw, so that the alveoli of the two correspond; for

the permanent molars of the adult are, then, seen to be in the same line with the temporary molars of the infant.

"The only mode in which we can conceive the lower jaw to be thus elongated is by a gradual absorption of the fore part of the coronoid and condyloid processes, and a gradual addition to the hinder part of those processes, as well as at the angle and along the hinder edge of the jaw. In this way the coronoid process, which is at first situated over the rudiments of the permanent molars, may become shifted to a plane behind them.

"I have already remarked that the additional molars of the permanent series grow up, on either side, in a continuation of a line formed by the primary teeth. Hence, though the bones of the alveolar arch are extended backwards, and the arch is rendered more elliptical, it is not widened. The widening of the jaw, in correspondence with the increasing width of the base of the skull, takes place almost entirely behind the alveolar arch, in the ramus, and must be effected by a progressive absorption on the inner surface, and an addition at the outer surface, similar to the absorption and addition that are taking place, respectively, at the coronoid and condyloid edges. Accordingly we find that, in infancy, the rami of the jaw are in a line with the alveoli; whereas, subsequently, they diverge considerably, and a well-marked obtuse angle, in a horizontal plane is formed, on either side, between the alveolar arch and the hinder portion of the jaw.

"The gradual diminution of the angle between the horizontal portion of the jaw and of the ramus, from an almost straight line to a right angle which is, partly, for the purpose of affording vertical space for the molar teeth, is effected by absorption at the base of the coronoid process in front, and addition at the 'angle' behind. These changes are most marked in the European members of the human family; and it is, probably, a consequence of these changes, and of the smallness of the angle in which the hinder molar or wisdom tooth is developed, that it is liable, in its growth, to intrude upon the mucous membrane in front of the coronoid process, causing irritation of it, and, so, imposing some penalty for the peculiarity of our configuration.

"In the upper jaw the changes are very similar to those in the lower. The permanent molars, developed behind and above one another in the 'tubercle,' descend and move backwards; and the space for them is formed by addition to the hinder part of the tubercle. During this period the contiguous pterygoid processes of the sphenoid bone undergo alterations similar to those in the coronoid processes of the lower jaw, that is, they receive addition behind, and are absorbed in front, and are so rendered more vertical. The malar eminence of the maxillary bone, and with it the zygoma, are, in like manner, thrown backwards; and, as the bone is deepened by addition to the alveoli, from beneath, and as the teeth grow down into the alveoli, and become distanced from the orbit, the interval between them and the orbit is occupied by the antrum."

On page 489 of the same journal under *Plasticity in Orthodontia,* we find, in an unsigned article, the following:

"The dental surgeon who has had many cases of irregularity in the upper incisors to correct, must at times have found it difficult to retain the regulating

plate sufficiently firm in the mouth against pressure inwards, if the teeth had to be pressed outwards, or against the pressing outwards if the teeth had to be drawn inwards. The ordinary methods of making the regulating plate secure in the mouth is by gold bands, silk ligatures, or capping the teeth tightly with gold.

"I fitted a vulcanite plate to the palate, extending to the molar and bicuspid teeth, and over the gums to the loose folds of the mucous membrane. I then cut it until it antagonized with the lower teeth. The cells were then cut behind the lateral teeth for the reception of the compressed wood. The plate was cut out a little inside, sufficient to admit a lining of gutta-percha, and was then thinned and polished. A few holes drilled on the buccal sides of the plate, together with the affinity the gutta-percha has for the vulcanite, is sufficient to make the two adhere together. After adjusting the gutta-percha to the mouth, which may be done by leaving it a few minutes in boiling water, drying it carefully, heating the vulcanite plate over the plate of a spirit lamp, and joining the two together, trim, and place into the mouth, desiring the patient to bring the teeth together hard. The surplus gutta-percha may then be trimmed off. After again heating the plate in boiling water, the same process is repeated, until the vulcanite plate is home. With the aid of cold water the gutta-percha must be made hard previous to withdrawing the plate from the mouth; and when the pieces of compressed wood are fitted to the cells previously made for their reception, the plate is ready for final adjustment, with three such plates, which are quickly and easily made. I pressed the two lateral teeth, first to the side (being behind the centrals), and then out, a quarter of an inch, in fourteen days.

"The advantages of the plastic method in retaining the plate are, that the teeth and gums are not irritated, as not unfrequently occurs when tying is resorted to; and the pieces of wood are more easily renewed, admitting of the daily cleaning of the plate by the patient, which is of so much importance to the preservation of the teeth. I order the plate and teeth to be daily cleaned with chalk and carbonate of soda, and afterwards washed in a weak solution of Condy's disinfecting fluid."

Alfred Coleman before the *Odontological Society of Great Britain,* February, 1865, read the following paper: *On Some Forms of Irregularity of the Teeth and Their Treatment, Considered Chiefly in Relation to Mr. Cartwright's Theory of the Influence of Selective Breeding Upon the Development of the Maxillæ,* which is published in the *Transactions of The Odontological Society, Great Britain,* page 227:

"There are two principal varieties of contracted jaw met with: in one the teeth bear their due relationship to the maxillæ, as regards actual development; but where the latter have their palatal processes raised into a higher and more pointed arch, and where the alveolar processes of each side become consequently approximated,—it is difficult to explain the cause of this deformity: in some cases the habit of finger-sucking, as suggested by Dr. Ballard, may have caused or increased it; in others, where no such habit has existed, it appears to be connected by links with those arrests of development which cause cleft palate. This variety, though congenital, may yet become hereditary, and

our notions concerning the form of countenance indicative of good breeding certainly tend to cause it to become so. The other variety is that in which the teeth are in excess of development as regards the maxillæ, or, to speak more correctly, where the maxillæ do not attain their average development, whilst the teeth attain their normal size.

"One thing is certain, that whether they arise from the causes suggested or not, they are daily becoming more common amongst us, and therefore the question of their proper treatment is one involving no small consideration. As the maxillæ in these cases do not attain their average development whilst the teeth attain their normal size, so that in fact there is too much tooth substance in proportion to the size of the jaws, two principles of treatment naturally suggest themselves: the one the increasing of the size of the jaws, if possible; the other the lessening the amount of tooth substance. Much has been written and much has been said upon the expansion of the alveolar arch, as if its accomplishment were a matter of but little difficulty. In my own efforts, chiefly, however, directed to the other form of contracted alveolar arches noticed, I have found that they have been unavailing. By fixed points for applying pressure, the teeth, have readily yielded and have been pushed to the outer margin of the alveolar process. The dental arch has been expanded, but not the alveolar arch; and this is only reasonable when we remember that resistance to our efforts is not only offered by this bone itself, but probably to some extent also by every other bone composing the face and cranium. Nor must we forget also the influence of muscular resistance, not only tending to counteract our efforts, but also to restore the former conditions upon the withdrawal of the expansive force. I have read of the two superior maxillæ being actually forced asunder at their palatal and labial articulations, in attempts to expand the arch, a state of things I should hardly think advantageous, and certainly not one I should feel very proud of having accomplished. For all practical purposes, I think, we may at once dismiss this method of treatment, though its usual result, the widening of the dental arch, demands more consideration.

"The nearest approach to a rule in the treatment of irregularities might be thus stated: 'that when the maxillæ are in regard to the teeth deficient in development, some of the latter should be removed, whereby the harmonious relationship of teeth to maxillæ may be restored;' and this practice would I advocate, not merely on the ground that the personal appearance is improved thereby, but also with the view of preserving the teeth themselves, the table before you showing their inferiority in the contracted and crowded dental arches."

John R. Mummery read a paper on *Abnormal Projection of the Incisors and Cuspidati*, which was published in the *Transactions of the Odontological Society, Great Britain*, 1866, page 73:

"In the first place I shall refer to the age at which, in my judgment, these cases should be undertaken. I believe that a very large proportion of failures are attributable to the mouth being treated for irregularity before the second permanent molars are erupted. If the first molar is removed before the roots of the second molar are well developed, we usually find that the grinding surface of the latter tooth, when it appears, is found inclined very considerably forward, furnishing a very indifferent masticating organ.

"As a general rule I defer commencing treatment until the patient is entering the fifteenth year, that opportunity may be afforded for the natural expansion of the maxillary arch, thus possibly obviating the necessity for sacrificing any of the permanent teeth.

"Although the first molars are proportionally more liable to decay than the bicuspids, I much prefer removing one of the latter teeth on each side, carefully selecting the first or second bicuspids, as there may be indications of incipient decay.

"I give early attention to the state of the molars with a view to their preservation, and fill with gold any cavity that may exist, at the earliest stage of disease.

"I thus secure a firm fulcrum for my plate, by capping one or both pairs of molars, or two molars and two bicuspids.

"My usual apparatus is of a construction very familiar to the members of this society—a broad well-strengthened gold plate, having strong springs of sixteen-carat gold-plate, No. 16, and well-hammered, soldered upon the lingual side-cappings of the molar teeth, and, as occasion requires, on the outer side also.

"In the great majority of cases, I, of course, recognize the importance of removing a corresponding number of teeth from the lower jaw, and when the lower front teeth strike against the necks of their antagonists, I always take the lower teeth under treatment before the upper; adopting, with slight modifications, a similar apparatus to that already described.

"The springs are brought to bear on one pair of teeth at a time, commencing with the bicuspids, and always bearing in mind as my chief object the expansion of the arch in the neighborhood of the cuspidati and bicuspids.

"The elastic springs admit of the most delicate adjustment, and the pressure should be so gradually increased, that little or no pain is induced; and each pair of teeth in succession may thus be treated, until at last the central incisors are brought into their proper position.

"The plate requires to be re-struck to a new model occasionally, and when all the teeth are reduced to a regular position, it is finally remodeled, and a slighter elastic spring on each side is soldered to the cappings, and accurately adjusted to the labial surfaces of the corrected teeth; they are thus retained in position, and the plate should be laid aside very gradually, continuing its use at night for a period of many months after the treatment is brought to a close.

"There are several advantages attending the use of gold plates thus constructed which, in my opinion, render this a preferable method of treatment to certain others which are sometimes adopted.

"The plate is easily removed by the patient, yet keeps firmly in its place.

"It can thus be cleansed three or four times a day, and the teeth well brushed, and a great amount of the alleged injury to the teeth is avoided.

"Although gold is harder than bone or vulcanite, yet it is not nearly so hard as the enamel, and I firmly believe that the decay on the crowns of teeth when in contact with gold plates (employed either for artificial teeth, or for regulat-

ing the dentition) is rather attributable to chemical than to mechanical action."

C. A. Marvin has a remarkable series of eight articles in the *Dental Times* commencing in Vol. 4, 1866. These I will quote in great detail as I believe it will be of sufficient interest to my readers. Under *Regulating Teeth* he states:

"This is a subject upon which much has been written and said, and upon which much more may be written and said, without any fear of exhausting it. As long as the proper care of children's teeth is so little understood, or so grossly neglected by parents; as long as the numerous known and the still more numerous unknown causes of irregular teeth exist in the world; so long will this branch of dental art possess an ever-new and ever-vital interest to the enlightened members of our profession.

"In regulating teeth, several objects are to be attained, and they are always to be kept in mind throughout the continuance of the operation. They are:

"1st. The preservation of correct facial expression.

"2nd. The restoration of such expression, (if, through the irregularity of teeth, it has been lost.)

"3d. The proper articulation of the teeth for better mastication.

"4th. Their orderly arrangement, with a view to the prevention of decay.

"Here is enough for four sermons, but within the limits of a single paper I can only generalize.

"One general principle may be asserted, however, which it were well if all dentists would observe, and that is this: do not resort to extraction for the purpose of giving room to such teeth as are out of position. This is an error into which many dentists have fallen, and from which have resulted cases of permanent disfigurement beyond the pale of recovery. I do not mean never to extract in regulating, for there is no rule, nor principle, nor condition to which there may not be exceptions; but I do mean that this method should be the very last resort.

"Nature makes all parts to correspond, and when she supplies a certain number of teeth in the mouth, it is fair to infer that the presence of all those teeth is necessary to regularity and perfection. If they are crowded, it indicates that there is unnatural contraction. What is the remedy? Expansion of the parts, of course. And when this is properly done, and sufficient room secured, with all the teeth retained, a symmetry of outline is observed, which is at once pleasing and natural, and which can be attained in no other way. In the most contracted mouth, by commencing with the first molars, and spreading them, then following with the second bicuspids, and so on, in order, to the central incisors, very rarely will any difficulty be found in obtaining sufficient space for such teeth as may stand outside or inside of the proper circle. In doing this, constant regard should be had to the facial expression, that the incisors be not moved so far outward as to give a swollen appearance to the lip. Where there is danger of this result, the bicuspids or molars should be made to furnish the largest share of the space required, as these teeth can be well spread without materially affecting the appearance of the cheeks. Two methods of accomplishing this end are in use, both of which are effectual. One is by fitting a plate to the roof of the mouth, (if the upper teeth are to be regulated) with broad collars

next the teeth which are to be spread. Between these collars and the teeth, wedges of dry pine wood or rubber are to be inserted as tightly as possible, and changed every day; thicker ones being substituted, until the teeth are moved as far as is desired. A second method, and an excellent one, is by making a bow of stiff gold wire, long enough to pass entirely around the teeth, from molars to molars. Fit gold caps accurately to the crowns of the last molars, on each side, and solder the ends of the gold bow to the buccal surfaces of these caps. When this appliance is firmly fixed in the mouth, elastic ligatures passed over the teeth which are to be moved, and attached to the bow, will draw them in any desired direction, and to the requisite extent.

"It is, of course, unnecessary to say that, after the teeth are brought into their proper place, a retaining plate must be made, which is to be worn until they are firmly set in their new position. The length of time required for this varies in different cases, from three to twelve months. It is of the utmost importance that this retaining plate should be what I have called it—a retaining plate. The teeth which have been brought from an improper to a proper position, should be held there immovably, that there may be nothing to prevent the perfect filling up of the alveolus, or tooth socket, closely around the roots of the teeth. If they are allowed to move backward and forward, Nature can not accomplish her work and they will not become firm. Attention to these little matters will oftentimes prevent much dissatisfaction to patients, and mortification to dentists.

"As to the age when art should be called in to aid Nature, opinions vary—I say to aid Nature, by which I mean that this should be done at some stage of the period of growth. While a tooth is growing, a very little force will change its direction, while much would be required after it is fully developed, and growth has ceased. But if begun too early, evil may ensue. Nature will many times, entirely unaided, correct irregularity. To employ artificial means, therefore, in such cases, would be not only unnecessary, but perhaps, hurtful, by producing unnatural irritation, or by inviting early decay through the friction of metallic appliances upon tender teeth, or by making convenient lodging places for particles of food to remain until partially decomposed. If, on the other hand, the treatment be delayed too long, either or all of the following evils may ensue: loss of some of the teeth in consequence of the too great rigidity of the parts for successful expansion; or difficulty of retaining the teeth in their new position, owing to the more tardy adaptation of the parts, and the slower formation of bony tissue in and around the roots; or the dangerous luxation of the teeth in consequence of prolonged traction, which tends to greater protrusion of the organ.

"The nearest to a rule which I can give, is this: to commence as soon after the necessity is apparent, as the dentist can determine this point; viz., that the eruption of teeth yet to come, or the subsequent growth of those already erupted, shall not undo his work; in other words, when he sees that the teeth he may succeed in regulating, are in no danger of being pressed out of position again by the new and growing teeth, and thus the repetition of the operation rendered necessary.

"The earlier the operation can be commenced, consistently with this caution, the better.

"Too great haste should also be avoided. Harsh measures in treating teeth, especially in the mouths of the young, are to be strongly deprecated. Teeth are delicate organs, and if a regard for the feelings of the young patients has no weight with the dentist (which it certainly should have), let this thought have weight; viz., an amount of irritation may be produced, which may result most disastrously. Slow, steady and unremitted motion is proper, but I have no sympathy with the sudden and harsh pulling and prying of teeth from one position to another. Gentleness, all the gentleness consistent with progress, should be practiced in every operation.

"Correct facial expression. What is it? It is not the mere absence of deformity. It is merely that condition of the features which enables the individual to use them at will in expressing joy, sorrow, disgust, pity, conceit, anxiety, or composure of mind. It is not merely that the nose is straight, and that the angle formed by its base and the right cheek is exactly equal to that formed by its base and the left cheek; that the corners of the mouth are level, and that the lips meet evenly. It is not that words can issue from the parted lips smoothly and unaccompanied by contortions or evidence of effort; that smiles of sweetness can play around the mouth, and an expression of unfeigned pleasure appear on the face, without a distressing exhibition of struggle between feature and feeling. It is more. Physiognomists tell us that the prominent traits of human character are marked upon the face. But, in my judgment, the subject which we are examining makes sad havoc with many of their theories. An absolutely correct expression of the face would undoubtedly be a physiognomical expression; but, taking expressions as we find them, physiognomy is sadly at fault. Let ten persons present themselves for examination according to physiognomy, strictly, and while undergoing examination, let them close their eyes and lips, and seven out of the ten characters would fail of being correctly delineated. Why? The soul—the seat of character—is shut in from view. Its windows—the eyes—are closed; the exponents of its varied sentiments and feelings—the lips—are fixed; consequently the inner being can not be seen, and judgment can only be formed from the features. Some general idea can be gained from these; but in the absence of the eye-glance and the mouth-motion, no reliable or minute opinion can be reached. It is only when the thought within is betrayed by the eye or manifested by the involuntary workings of the features, that the revelations of the science of physiognomy, so aided, can be relied upon.

"Now, it may be asked, what all this has to do with regulating teeth. And perhaps a smile of approval may cross the lips of the reader as he sees the question. Do not let us forget, my practical friend, that as members of a profession, which claims to be a learned profession, we not only have the right, but should esteem it a duty to investigate closely as to remote details. It is easy to arrest the seeker after knowledge when pursuing a line of thought to remote depths, with a blunt, practical question, and sometimes it is necessary; but it should not be thrown in until the irrelevancy of the examination is apparent, else it not only chills the eager investigator, but betrays an absence of perception on the part of the objector, not specially flattering.

"It is not intended that all dentists should immerse themselves in the study of physiognomy as a science, that these remarks are made, but to show that

the study of the expression of the face is an important subject; that it has been so deemed, and that it is so deemed in the present day; and it will not do for the practitioner of dentistry, who claims to be an intelligent and competent man, to ignore it, or say there is little in it. Physiognomy, as I have intimated, can not, in my judgment, substantiate all that it claims. Its far-fetched inferences and fine-spun theories are too multiform and minute; but there is something in it, even as a science. There is more good, however, in its effect than in itself. Its effect is close scrutiny of the human countenance; and if we are at all interested in it as a science, we find ourselves endeavoring to trace on the human face evidences of what we know to be prominent traits in the character.

"Now this is just where I wish to bring my readers, in this article; viz., to become students of the human face. Not for the purpose of establishing any theory, or propping up any 'ology' whatever, but that they all may be able to determine for themselves what correct facial expression is. This is of prime importance to the dentist. I can not find language too expressive to set forth my estimate of its value; nay, of its indispensable necessity.

"How can a dentist insert an artificial denture that shall be an evidence of professional skill, unless he is able to determine what expression of the mouth he is to secure? In the absence of this knowledge, what is he but an artisan, and his set of teeth the product of mechanical skill alone.

"Some general directions may be given for the formation of an opinion as to correct expression. But such directions can only be very general. The details can be gained by study alone.

"First, then, observe the outlines of the face; notice the prominence of the forehead and of the chin, and the fullness of the cheeks.

"Next, observe the relations between this feature—the mouth—and the other features; is it so related to them as to attract no special attention to itself, is the harmony of the features unbroken, and when a front view, a quarter view, or a side view is taken, do all appear well balanced? If so, let them remain thus; and, in all the operations upon the teeth, let great care be taken not to disturb the outward expression.

"Many a person has been so changed in the expression of face by dental operations, as to be hardly recognizable by their friends. Their identity has been lost. Such is not dental art. Improvement, or no change, should be the rule, and the dentist should fit himself to work by this rule.

"Sometimes, in order to correct the irregularity caused by a contracted arch, upper, for instance, it may be necessary to throw out all the teeth, enlarging the entire arch, and to do this to such an extent as to give the incisors an outward slant or inclination. Indeed, this has to be done at times to such a degree as to leave a deep impression in the upper lip just at the base of the nose. This irregularity will sometimes require the insertion of a mechanical appliance for its entire correction. If this enlargement of the arch is effected in the mouths of children when quite young, the depression in the gum just above the roots of the teeth may fill up by the growth of the parts. If so, well. When performed on patients over the age of fifteen, there is little hope of this consummation being effected by Nature. In such cases, a well-shaped and accurately fitted 'plumper' of vulcanized rubber extending around the entire upper

gum, from molar to molar, and secured by slight and ingenious attachments to the molar teeth, will bring out the lip to its required fullness, and be of no inconvenience to the wearer.

"I come now to consider the third general rule, of those heretofore enumerated, to be observed in operations for regulating natural teeth; viz.,

"The proper articulation of the teeth for better mastication.

"A moment's reflection will convince anyone of the vast importance of this arrangement. Of the distinct operations, mastication, deglutition, digestion and assimilation, by which food is converted into animal substance, and strength becomes the result, the most important is the first. Nature has assigned to each part of our physical machinery a distinct duty. To the mouth, mastication and insalivation; to the stomach, digestion; i. e., the dissolving of the swallowed mass, the separation of the nutritious from the useless; to the absorbents, the appropriation of the nourishing elements, and the dispatching of a portion to each needy part of the organism. If the first operation, mastication, be imperfectly done, and the food be swallowed before it is thoroughly ground, an additional duty is imposed upon the stomach, already assigned a sufficiently laborious task.

"To accomplish this will, in some cases, be very difficult. Perhaps it can not be gained at the time the operation for irregularities is being performed. But patience, fellow-practitioner! The employment of wise means, and persistence in their application, will secure the end desired. Nature assists the skillful operator. Let me instance a difficulty. The upper arch is greatly contracted; the molar teeth only meeting their antagonists. The bicuspids, cuspids and incisors all shut inside the lower teeth, none of them touching, none of any use in mastication. What is to be done? Spread the upper arch, of course.

"When this has been done so far as to bring the bicuspids, out to a proper position, it is found that the first bicuspids, for instance, are too short; they will not reach the lower ones. This evil can not be remedied at once. It will not do to seize the tooth and drag it out of its socket far enough to reach its antagonist. But it must come down. How then? Coax it. A ring of rubber left around its neck will produce an irritation sufficient, oftentimes, to accomplish the purpose. But sometimes this will not do. If the mere absence of antagonism will not induce its protrusion, which result often occurs, particularly in adult life; if irritation at the neck is equally unsuccessful, it still can be done by gentle traction.

"Make a plate of rubber or metal, with a reversed gallows under the tooth. To this gallows attach the tooth by an elastic band of slight strength, and the requisite length can soon be gained. This is a delicate operation, and must be carefully performed. No 'heroic' method will do here. Gentle means, often intermitted, again resumed, the effect carefully noted, and a knowledge of what is being done, these will insure the desired result. And even one case of irregularity, successfully brought to a condition which is natural, symmetrical and useful, will amply repay the practitioner for all the study, pains and skill its treatment has cost him."

Sidney Longhurst contributed a paper on *Lateral Abnormalities*, which we find published, page 83, *Transactions of the Odontological Society, Great Britain.*

"A very singular circumstance connected with the upper laterals is the comparative frequency of their absence altogether in some mouths. Doubtless, many practitioners have noticed this omission in two or more mouths of the same family. If we except the wisdom-teeth, I think we may venture the assertion that there is no pair or class the absence of which we have oftener to note; putting, of course, out of consideration those cases where, in childhood, they may have been removed, in error or otherwise, for the purpose of regulation.

"In the union of the permanent teeth, the laterals also will be found to figure conspicuously. Indeed, in almost all the cases sketched by the several dental writers, in the majority, at least, this tooth will be found involved.

"Again, the mould or fashion of these teeth seems to wander more frequently from the normal shape than others. The flattened lower labial surface, so beautifully described in what we are wont to regard as the typical form of lateral, and which, with the non-diastema and short canine, appear to give that expression to the mouth so eminently human, oftentimes, in whole families, seems to degenerate into a small misshapen cone or a mere enameled peg—teeth which, if removed from the mouth, it might well be a subject of conjecture as to what part they had belonged, or whether they had formed any part of the human economy at all!

"Several authors have mentioned cases where three well-developed laterals have been present. I frequently see a gentleman in whose upper jaw there are three, all well-arranged within the arch, and each perfectly formed. These may perhaps be regarded as merely cases of supernumerary teeth, and such undoubtedly they are. But it is to this that I would point: The surplus teeth have been laterals. And, further, that, in three-fourths of the cases of supernumerary teeth I have seen or heard of, I have noticed that the intruder has generally presented itself in this locality, namely, before, between, or behind the centrals and canines. And, lastly, that supernumerary teeth, although occasionally simulating bicuspids and dwarfed molars, yet, as a rule, more closely resemble, in size, position and figure, one of those 'misshapen cones,' or in other words, mal-formed laterals, than any other class of teeth."

Here again we find what careful observations were made and the knowledge our early scientific workers possessed.

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

James David McCoy, D.D.S., Editor
Los Angeles, Calif.

ROENTGENOGRAPHIC STUDY OF INFECTED AREAS ABOUT THE TEETH

By Virgil Loeb, A.B., M.D., D.D.S., St. Louis, Mo.
Professor of Oral Surgery, St. Louis University Dental School.

IT has been fully demonstrated that no study of any condition involving the mouth and contained organs is complete without a roentgenographic examination, and further argument to this end is unnecessary. The extent of such an examination, however, depends upon the requirements of the particular case. The purpose of this article is to show, chiefly by the accompanying illustrations, the added information which is always to be obtained when complete sets of roentgenograms are employed in searching for infected areas about the teeth.

Clinical experience has shown us that the general appearance of the tissues about the teeth, together with a consideration of the symptoms enumerated by the patient, often misleads us in determining the particular teeth which are affected. Often we are guided too much by the statements made and fail to find the essential focus because there are no symptoms pointing to it. On this account, it has been my practice for some time, to have roentgenograms of all the teeth made whenever possible. This is important for several reasons. First, definite evidence is provided independent of what the patient may say about his symptoms, by reason of which the physician's or dentist's attention is directed to the pathologic process present. Secondly, we are able to study collectively the normal and pathologic conditions as they exist and in the normal relationship of the teeth.

In order to do this in a satisfactory way, it is necessary to arrange and to mount the negatives in some convenient way. This can be done either by mounting the negatives on celluloid sheets, especially made for the purpose, or between two pieces of glass, the pieces being held together by passe partout.

The latter method is to be preferred since it removes any possible chance of injury to the negatives, and it permits a far more convenient filing plan.

The accompanying illustrations show the arrangement of the negatives for study. It is noted that the teeth occupy their normal relation to one another, by reason of which the site of any lesion may be at once identified and fixed. The grouping plan permits the study of the case as a whole so that the operator may determine what teeth to remove and what to retain for artificial work or other purposes.

It is not intended to suggest that this method of mounting is new, but to show by the illustrations concrete value of the method.

Case I.—Extensive absorption of alveolus around all teeth with exception of lower right cuspid, bicuspids, and first molar. Lower left lateral incisor is held in position by wire only.

Case II.—Support of all teeth, with exception of upper and lower anterior ones, almost gone, due to absorption.

Case III.—Practically all teeth hopelessly affected due to defected areas at apices of roots and absorption of the process.

Case IV.—Absorption of alveolus, with complete destruction around lower right second molar and upper right first molar.

Case V.—General absorption of alveolus. Note symmetry of same.

Case VI.—Absorption of alveolus noted chiefly in upper left molar and lower right molar regions.

Case VII.—Radical absorption of alveolus with definite infected areas at apices of many roots.

Case VIII.—Absorption of process and infected areas at apices of several roots. Hopeless teeth held in position by bridges.

The International Journal of Orthodontia

PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 801-807 Metropolitan Bldg., St. Louis, Mo.

Foreign Depots—*Great Britain*—Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

Subscription Rates—Single Copies, 30 cents. To anywhere in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $3.00 per year in advance. Under foreign postage, $3.40. English price: 15/ per annum, 1/6 per number. Volume begins with January and ends with December of each year.

Remittances—Remittances for subscriptions should be made by check, draft, postoffice or express money order, or registered letter, payable to the publishers, The C. V. Mosby Company.

Contributions—The editor will be pleased to consider the publication of original communications of merit on orthodontic and allied subjects, which must be contributed solely to this journal.

Opinions—Neither the editor nor the publisher hold themselves responsible for the opinions of contributors, nor are they responsible for other than editorial statements.

Reprints—Since it is not desirable to hold type standing longer than absolutely necessary, all requests for reprints should be made at time of submitting manuscript for publication. Rate card will be sent with galley proof.

Communications—Contributed articles, illustrations, letters, books for review, and all other matter pertaining to the editorial department should be addressed to the Editor, Doctor Martin Dewey, 25 East Washington Street, Chicago, Ill. All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 801-807 Metropolitan Building, St. Louis, Mo.

Illustrations—Such halftones and zinc etchings as in the judgment of the editor are necessary to illustrate articles will be furnished when photographs or drawings are supplied by the authors of said articles.

Advertisements—Objectionable advertisements will not be accepted for publication in this journal. Forms close first of month preceding date of issue. Advertising rates and sizes on application.

Change of Address—The publishers should be advised of change of subscriber's address about fifteen days before date of issue, with both new and old addresses given.

Nonreceipt of Copies—Complaints for nonreceipt of copies or requests for extra numbers must be received on or before the fifteenth of the month of publication; otherwise the supply is apt to be exhausted.

Entered at the Post Office at St. Louis, Mo., as Second-Class Matter

EDITORIALS

The Teaching of Orthodontia in Dental Schools

THERE is no subject taught in dental schools about which there are so many different opinions in regard to the proper method of teaching and what should be taught as the science of orthodontics. In times past nearly every dental school taught the subject differently and required a different length of time to be devoted to the subject. It was a common practice with the majority of schools a few years ago, to make orthodontia a part of prosthetic dentistry, and that plan is still followed by some schools at the present time. There is no question but that orthodontia is too large a subject to be given only the small interest it would receive if made a department of prosthetic dentistry or any other phase of dentistry.

In fact, modern orthodontics as we know it today occupies a field which in reality is almost too big to be handled successfully in the dental college

curriculum. However, we are confronted with the fact that orthodontics must be taught, and with the arrangement of a four year course, we are made to realize that orthodontics must be given more of a place than it has had in times past and some standard must be reached for teaching it. In the beginning, we might just as well concede the course must be divided into two parts, that is, a lecture course and a clinical course. You will also be confronted with the proposition that some men believe in giving a very extensive clinical course in orthodontics, while others claim that it should be limited.

We realize the proper procedure lies somewhere between the two extremes. In regard to the lecture course there is not such a difference of opinion as there was in former years. With the progress in orthodontics and the realization that occlusion is the basis of orthodontic study, most lecture courses now begin with the consideration of occlusion of the teeth and a study of the malocclusion as diverging from that point. These lectures on occlusion should include a thorough study of tooth forms with the occlusion of the inclined planes of the teeth. Following that there should be a consideration of the forces of occlusion and the factors establishing normal occlusion and attention must be called to the fact that a perverted force of occlusion will also become a factor in the production of malocclusion. We must make a study of the malocclusion of the teeth and facial deformities based upon the present accepted plan and the student must be familiar with the terminology so he will know what the lecturer is talking about.

The use of the nomenclature adopted at the last meeting of the American Society of Orthodontists will be found to be of great assistance to the men who are teaching orthodontics in dental colleges and they should insist upon the students becoming familiar with it. We believe that no greater step ever was made in the teaching of orthodontics in dental schools than when the American Society of Orthodontists agreed upon a nomenclature which had been worked out by men who had been engaged in teaching orthodontics for a number of years and who, because of their experience, realized that those terms carried a meaning to the students that the terms used in the past did not convey.

It must also be remembered that these courses of lectures to be given to students in orthodontics should be followed by a series of quizzes, or possibly better, the quiz should precede the lecture. When the students are assigned a chapter on a subject in a recognized textbook and allowed to read it, and this is followed by a quiz, we believe the majority of students will obtain a better knowledge if the old lecture system were carefully adhered to and the student expected to gain his knowledge entirely from the lectures. We realize that a great many men can give a lecture which is very instructive and we have also learned from observation that a lecture that is interesting and instructive very often passes over the heads of a majority of the students. By combining the quiz and lesson assigning system with the lecture plan, we believe the student will obtain a greater knowledge of the fundamentals of orthodontics than he will if his entire time be devoted to lectures. A study of the causes of malocclusion must also be considered from every standpoint. Special attention should be paid to those conditions which are produced as a result of mechanical interference with the occlusion of the teeth including conditions produced by

extraction of the deciduous teeth and other dental operations, but we must also remember that a certain number of malocclusions have their beginning in constitutional conditions which must be emphasized. While a number of malocclusions are influenced by the mechanics of the teeth or by the forces of occlusion, there is also a large percentage of malocclusions produced by faulty cell metabolism having its origin in constitutional conditions which have not been recognized as they should have been in times past.

When we come to the consideration of regulating appliances as they should be taught in dental schools, we realize we are reaching a subject about which there is going to be much discussion. Men who have a particular style of regulating appliance believe that appliance is the only one that should be taught to students. If orthodontics is a science the question of regulating appliances should be taught in a purely scientific manner, based upon recognized physical and mechanical rules. Therefore, the study of regulating appliances should begin with a study of the physics of appliances and every appliance considered should be considered from the standpoint of efficiency based upon recognized mechanical laws. If this plan is followed, the student will be able to consider regulating appliances upon their merit and not because the appliance is advocated by a particular individual or pushed by a particular commercial concern.

Retaining appliances should be considered in the same way and special attention both in regard to the regulating appliances and retaining appliances should be paid to the histology and the physiology of tooth movement. We realize that a regulating appliance is simply a means of exerting force upon a malposed tooth for the purpose of creating cell activity, as cell activity is a necessary adjunct in the proper treatment of the malocclusion. It, therefore, follows that a proper course in orthodontics will be one that will include a study of the tissues surrounding the teeth, and if this course is given under the chair of histology in colleges it will relieve the man, who is teaching orthodontics, of considerable work.

One great trouble in times past has been that dental anatomy has not been properly taught from the standpoint of occlusion, and consequently the man who taught orthodontics was also compelled to teach more or less dental anatomy. Likewise, in histology no attention was paid to the tissues surrounding the tooth from the standpoint of orthodontic treatment and consequently the man who taught orthodontics was compelled to devote more or less time to histology. If the courses in dental anatomy, histology, and orthodontics can be worked together, each man teaching the subjects so as not to overlap one another and still laying the proper importance upon each phase that is required from an orthodontic standpoint, it will relieve much of the difficulty encountered in times past in teaching dental students.

When we come to the consideration of the treatment of cases there is no question but that an outline of the different principal types of cases should be given in a lecture course. The student should be assigned from a text the treatment of the different types outlined in textbooks and the lecturer supplement such study with certain cases from his own practice. When we come to the treatment, we are confronted with the question as to what should be done in the way of clinical orthodontia.

In times past the orthodontic clinic in dental schools has been very much abused and very poorly and unsatisfactorily conducted. In some schools the orthodontic clinic has been under the supervision of some man engaged in other work and the students have been assigned a certain number of malocclusions which they were to treat. In some schools the students treated one or two cases during their senior year and in the majority of instances with very unsatisfactory results. The reason for this has been that the student, as a rule, has had very little interest in the subject and the lecture course has probably been incomplete and insufficient and he has not had a demonstrator in charge of the case who was particularly interested in the outcome of the treatment. Because of this the appliances have been poorly constructed and poorly made, and the result from the standpoint of treatment unsatisfactory. Very few students are able to finish a case during their college year, and the case passes from one class to another with more or less unsatisfactory results. We realize occasionally that a student will get a satisfactory result in the treatment of his case and in some instances much good will be accomplished. In some instances we have seen results which are very unsatisfactory and the patient would have been much better if nothing had been done. However, this by no means solves the situation and we realize that something must be done in regard to the standardization of orthodontic clinics in dental schools.

The best way to accomplish this standardization is for the dental schools to realize that the orthodontic clinic must have demonstrators in charge who are interested only in that line of work. There must also be a sufficient number of demonstrators to carefully supervise the construction of all appliances and see that they are properly applied, and that the student does not neglect the work. In addition to that we believe the demonstrator should carry a certain number of cases through under his own personal supervision, doing all the work upon those cases and having the student observe the proper treatment of those cases under his care. By this plan we really believe that much good can be accomplished and probably more real instruction given to students than can be obtained in any other way. However, we realize that the number of cases the demonstrator could take care of himself would be limited and there is left a large number of cases of malocclusion which could not receive treatment because of financial conditions unless they can receive the same in a dental college clinic. We realize that when we advocate that the dental student should treat malocclusions in dental college clinics, a large number of practicing orthodontists are going to be opposed to that plan and they are opposed to it more or less justly. Their opposition is based on the unsatisfactory results they have seen in times past and there will continue to be unsatisfactory results even under the most favorable conditions. However, conditions can be improved by having a competent number of demonstrators as we have suggested in other parts of this editorial. Dental students perform operations upon patients in other lines of dentistry, they fill root canals, they make bridges, they construct plates, and in a great many instances render the patient a service, and in many more instances the work is not up to standard. However, people who attend dental college clinics realize the work is being done by students

and they can hardly expect the same results they would expect from one with years of practice or who was especially skilled in that particular line of work.

The same is true in the correction of malocclusion. There are a large number of malocclusions which students could improve and benefit even though the results were not so ideal as would be obtained by a practitioner of orthodontia in private practice. We also realize that in each dental class there are a number of students who are interested in orthodontics and would probably be glad to take up the practice of orthodontics in later years. We also realize that there are a number who have no interest in orthodontics and do not care for the work, and as a result of that, experience in an orthodontic clinic to a certain extent separates the desirables from the undesirables. To those who have not the painstaking care necessary for the practice of orthodontics, nothing will so forcibly impress it upon them as to attempt to treat a case in a college clinic. By treating a case or two in a college clinic, a great many men will not attempt any more cases after they go into general practice and as a result of that the public will be relieved of a large number of failures and unsatisfactory conditions which we have seen in private practice from men who, because of inexperience in a college clinic, concluded that the treatment of malocclusions was very easy.

We realize the fact that it is almost impossible to get a group of orthodontists to agree upon the proper plan of teaching the science in dental colleges; nevertheless, the subject must be taught, and is being taught; and the sooner orthodontists realize that they can advance orthodontics by reaching some concerted basis for the teaching of the same in dental colleges, the better it will be for the science.

Report of the Committee on Nomenclature

AT the meeting of the American Society of Orthodontists, held at Excelsior Springs, Missouri, the Committee on Nomenclature recommended the use of the following terms which were adopted by the Society:

Neutroclusion to designate such malocclusions as are characterized by normal mesio-distal or normal antero-posterior relation of the lower dental arch to the upper dental arch.

Distoclusion designates such malocclusions as are characterized by a distal or posterior relation of the lower dental arch to the upper dental arch.

Mesioclusion to designate such malocclusions as are characterized by a mesial anterior relation or of the lower dental arch to the upper dental arch.

Malpositions of the teeth to be defined as the relation which the individual teeth bear to the normal line of occlusion, the median line of the face and the individual denture.

Mandibular teeth to be used in preference to lower or inferior teeth.

Maxillary teeth to be used in preference to upper or superior teeth.

Mesioversion—a tooth which occupies a position too near the median line of the face.

Distoversion—a tooth too far from the median line of the face.

Buccoversion—a tooth which occupies a position buccally to the line of occlusion.

Linguoversion—a tooth which occupies a position lingually to the line of occlusion.

Supraversion—a tooth which is too long as related to the plane of occlusion.

Infraversion—a tooth which is too short as related to the plane of occlusion.

Torsiversion—a tooth which is rotated on a perpendicular axis.

Transversion—a tooth which is in the proper vertical plane, but is in incorrect numerical order.

Perversion—an impacted tooth lying in an abnormal plane.

Deformity of the jaws to be used in reference to extreme malformations and maldevelopments.

Macromandibular Deformity—a mandible which is too long.

Macromaxillary Deformity—a maxillary which is too large.

Micromandibular Deformity—a mandible which is too small.

Micromaxillary Deformity—a maxillary which is too small.

Orthodontia to be used for the practice.

Orthodontics to be used for the science.

Orthodontic to be used for the adjective.

Orthodontist, one who practices orthodontia.

In studying the list of terms as presented by the Committee on Nomenclature it will be observed that the words ending in *clusion* are used in description of the relation of one arch to the other. In speaking of the position of single teeth they are spoken of as malpositions in order to avoid confusion of the position of individual teeth with arch relation.

The ending *version* is used to designate the position of an individual tooth because it has been found less confusing with students to explain different positions of malocclusion and arch relations if terms are used having different endings.

It will also be observed that the committee has recommended the use of *mandibular* and *maxillary* in preference to the words *inferior* and *superior.* It is hoped the dental profession will use those terms as they are more scientific in describing teeth than the words *upper* and *lower* or *superior* and *inferior.* It will also be noted that the term *torsiversion* has been adopted to describe a rotated tooth in preference to the term formerly applied *torsoversion* or *torsoclusion.* The ending *i* in preference to *o* was adopted because it is more descriptive and more correct. The terms used to describe deformities of the jaws we believe are self-explanatory. The committee was also wise in suggesting the use of *orthodontia, orthodontics,* and *orthodontic,* for we are now enabled to have a terminology which describes the practice and appliances used more accurately than terms formerly employed. While the work of the committee is by no means complete, we believe that the science will be advanced by using a more definite terminology than was formerly employed.

Oral Abscesses*

WITH the development of dentistry as a science and greater attention being paid to bacteriology and pathology of the teeth and the surrounding structures, it is only right and proper that a book should appear devoted to the subject of oral abscesses. The book as written by Dr. Thoma includes the study of phenomena of infection, the various principles involved in the process of infection, local, general, and secondary. The classification of abscesses is considered, as well as the pathologic development and diagnosis of alveolar abscesses caused by diseases of the dental pulp. A very complete classification of the varieties of peridontitis is taken up along with the etiology of the disease, complications, and termination.

The histopathology is also considered along with secondary complications following the treatment of oral abscesses. We may not exactly agree with everything the author says in regard to classifications of causes and conditions; we may not agree with the treatment he advocates in all instances; however, the book is a valuable addition to any library. Its illustrations can not be surpassed and it fills a long felt want, owing to the fact that it is a book devoted to one particular phase of dentistry and the author has confined himself to his subject. The book should be in the hands of every dental practitioner, for by careful study of its pages he will have a much greater respect for conditions associated with, and known as, oral abscesses than he has had in times past. Many radiographs are shown, as well as a number of colored illustrations. The book as a whole is a credit to the author and its publishers and a valuable adjunct to dental literature.

*Oral Abscesses. By Kurt H. Thoma, D.M.D., Lecturer on Oral Histology and Pathology and Member of the Research Department of Harvard University Dental School, etc. 213 pages, 293 illustrations. Published by Ritter & Company, Boston, 1916.

The International Journal of Orthodontia

Editor: Martin Dewey, D.D.S., M.D.

VOL. III | ST. LOUIS, NOVEMBER, 1917 | NO. 11

ORIGINAL ARTICLES

THE HAWLEY ARCH FORM CONSIDERED FROM AN ENGINEERING STANDPOINT.—A SCIENTIFIC SUBSTITUTE*

BY RUDOLPH L. HANAU

Consulting Dental Engineer, Pittsburgh, Pa.

THROUGH my intercourse with orthodontists, I have become convinced that a very serious defect exists in the teaching of the determination of the correct arch form of the denture. The object of this paper is to acquaint those interested with the fundamental principles involved and their proper application. The investigation of a denture in malocclusion presents an engineering problem, and as such, requires an understanding of descriptive geometry, mechanics, and kinematics.

Many have an excellent perception of the various arch forms and its malformations; but what the student most needs is a guide that will enable him to analyze the facts he has to contend with, so that he may draw his conclusions through reasoning, not based on elastic "rule of thumb," but on scientific foundations.

For our purpose it is advisable to introduce new terms for the familiar nomenclature of the denture. It is believed that the changes and additions which have been made will measurably enhance the usefulness of the work.

Teeth, and other units are designated by letters, and indices are added to differentiate the various units. For the purpose of reference, a code is added.

The endeavor has been to present the results in the most simple form. No attempt is made to standardize the arch form, but the manner in which it may be standardized is indicated.

Because of the limited amount of time allotted to the reading of this paper,

*Read before the Sixteenth Annual Meeting of the American Society of Orthodontists, Pittsburgh, Pa., July, 1916.

due consideration can not be given the entire dental arch or to the influence of the formation of the individual teeth or to their shape. The incisal region is dwelt upon more elaborately, while the posterior extensions are dealt with in a general way.

A complete general analysis of the dental arch in a horizontal projection is given, and a graphic method of investigation presented. It is primarily a graphic method, but this is shortened by obvious, simple analytic aids.

Black's "Descriptive Anatomy of the Human Teeth" has been the greatest aid in the preparation of the paper; Angle's "Malocclusion of Teeth," Talbot's "Irregularity of the Teeth," and Hawley's paper on "The Dental Arch" were used for reference.

I desire to acknowledge my indebtedness in the preparation of this paper to Mr. C. H. Alsberg, my associate in the preparation of the drawings; to Dr. Ralph Waldron, for advice; to Dr. R. Ottolengui, for interesting plaster casts for study and investigation; to Dr. E. W. Schumacher, for an excellent specimen of a skull with an almost perfect denture.

Malocclusion of teeth is the result of either external or internal disturbances, or of both, during the growth of the denture, which are more or less known to dentists and orthodontists. Teeth, like plants, etc., are products of nature, and must be treated as such. Plants grow with their roots toward the center of gravity of the earth, the stem and foliage in the opposite direction; but, by natural or artificial means, they can be forced to deviate from their natural direction of growth. By the elimination, counteraction, or stimulation of natural influences, the same results can be obtained in the treatment of malocclusion.

It is not my intention to write of a denture from the standpoint of a practicing physician or dentist, but, rather, to show how its construction may be scientifically investigated from the engineer's point of view.

The dental arches consist of a plurality of units, the teeth. These are located in adjacent positions in each arch, and the two arches are in such relation that they conform to certain geometric, mechanical and kinematic requirements.

The language of the engineer is that of the drawing board. The drawings are the words; points, lines, and symbols are the letters; descriptive geometry is its grammar.

It is only natural for an engineer to approach such a complicated structure, as the denture represents, by an investigation on his drawing board. The results obtained have been very satisfactory and have already been presented to the dental profession in various forms by me, as well as by those whom I have interested in looking at the denture from this scientific viewpoint.

By means of orthographic projection, an object may be most accurately and conveniently pictured on a plane. At least two projections are required to locate points of an object in space, though more than two projections will often be necessary to convey a clear representation of the object. We must know the position of its points in space. In a denture, we should represent points of interest of the teeth, such as the cusp, summits, contact points, and

Fig. 1.

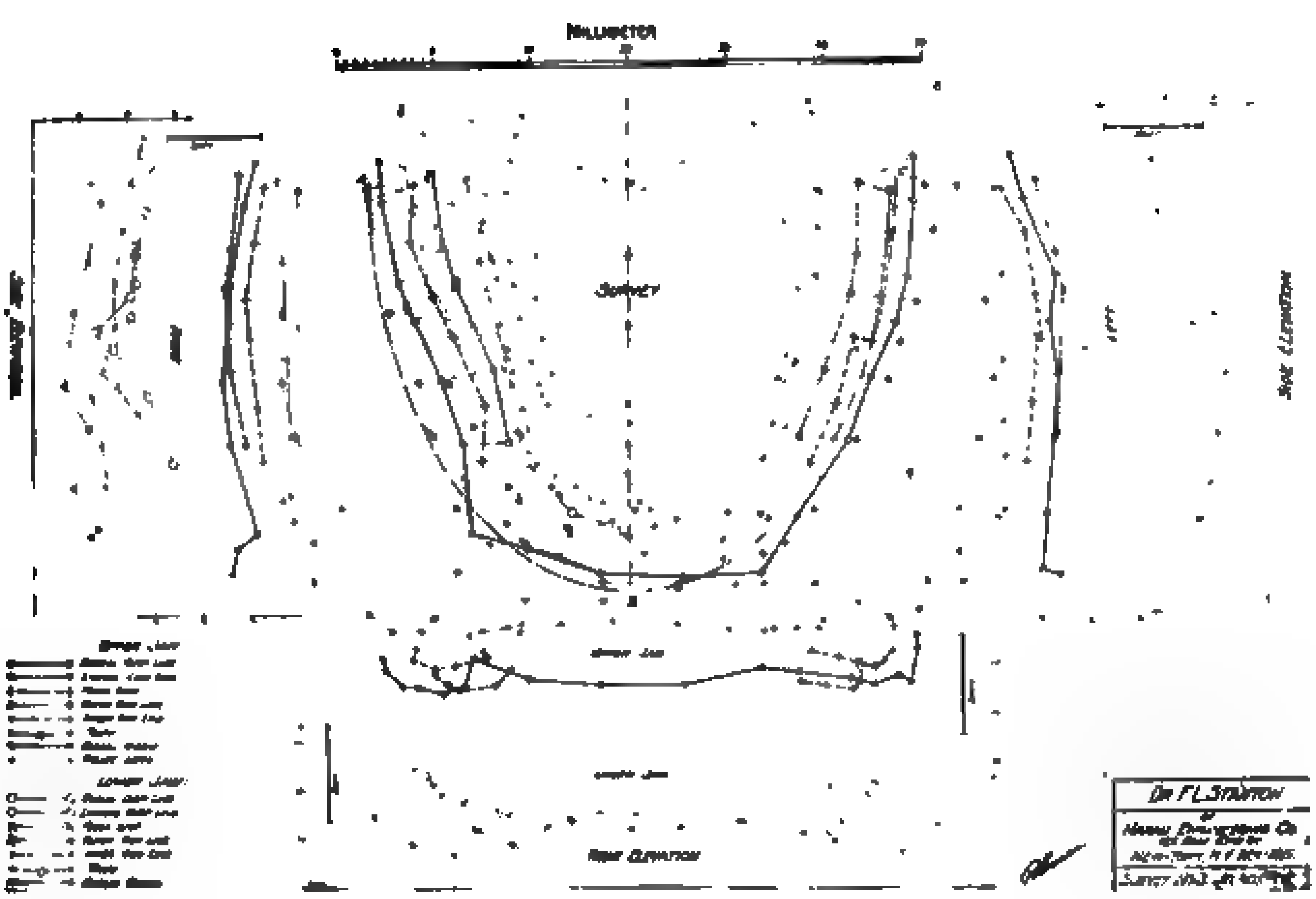


Fig. 2.

other prominent points. To accomplish this, the Stanton-Hanau surveying apparatus (Fig. 1) has been devised, by means of which points have been transferred orthographically to a plane, and their elevations have been read. By using various colored carbon papers on the recording sheet and copies, series of points have been differentiated (Fig. 2), then a pantograph (also some other methods) was used to enlarge the surveys so that a more thorough investigation could be made. I have used successfully a surveying apparatus for about a year; but, in the long run, the work has proved too tedious. Another drawback was due to the fact that the men in the dental profession, who had had no training in the reading of drawings, did not like the surveys because these did not readily convey to them the information desired, and because they are accustomed to representations of their plaster casts in photographs which have the advantage of showing every detail. It must not be forgotten, however, that the ordinary photograph is a perspective, and, as such, is not suitable for a scientific investigation of this problem.

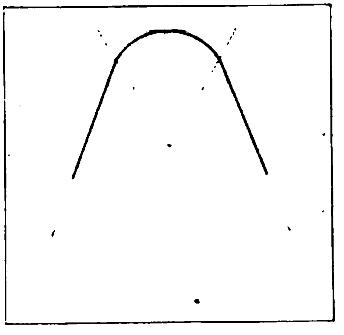


Fig. 3.

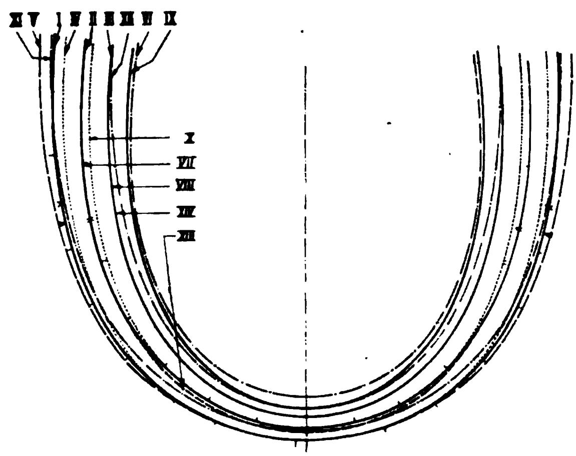
It is not my purpose to go into past history regarding the earlier and various stages in the development of the dental arch form; but rather to examine the merits of one arch form which by the dental profession is generally regarded as the correct form—the Hawley arch.

The Bonwill arch and the Hawley method of construction, illustrated in Fig. 3, which have long served in orthodontic work, are based on the assumption that the anterior teeth are arranged on the arc of a circle having a radius equal to the sum of the mesio-distal diameters of the central, lateral, and cuspid. Only in exceptional cases this method has proved successful; in some cases it very closely approximated the actual requirements, but in most cases, upon investigation, it has been found that the practice of using the dimensions of the three upper anterior teeth as the radius of the circle is absolutely erroneous.

According to the Hawley method, the anterior teeth are arranged in a circle drawn with a radius equal to the sum of the three upper front teeth. The posterior teeth are then to be found on straight lines drawn from the distal angle of the upper canine to the corners of the equilateral triangle. These lines form an angle of not quite 70° with the base of the equilateral triangle.

How this Bonwill or Hawley arch could so religiously be adhered to by the dental profession is not quite clear to the author. There is absolutely no reason why the form of all human dentures should converge upon one geometric figure, which would mean that in proportion the size of the individual teeth, as well as the size of the entire lower jaw, must increase or decrease in the same ratio as it does in the upper. It is well known that this is not the case; in fact, hardly any two dentures are found to be alike. Consequently there can not be one geometric figure to dominate the complex relations found in the denture.

In applying the Hawley arch, no attention has been given to the interrelation



DENTAL CURVES

CURVES	UPPER	LOWER
BUCCAL CUSP	I	VII
FOSSAE	II	VIII
LINGUAL CUSP	III	IX
COMPENSATING CONTACT	IV	X
OUTER GUM	V	XI
INNER GUM	VI	XII
OUTER CURVE OF OCCLUSAL CONTACT	XIII	
INNER CURVE OF OCCLUSAL CONTACT	XIV	

Fig. 4.

of the upper and lower anterior teeth, and likewise, the interrelation of the posterior teeth is neglected. The relation of the teeth of both upper and lower jaw in space, perpendicular to the plane of the arch, is not mentioned at all.

The different curves of the denture in their horizontal projection can best be seen in Fig. 4. All these curves are continuous in their course and represent curvatures very nearly coinciding with the corners of the respective lines connecting like points in one jaw.

UPPER JAW

I. Buccal Cusp Curve
II. Fossæ Curve
III. Lingual Cusp Curve
IV. Compensating Contact Curve
V. Outer Gum Curve
VI. Inner Gum Curve

LOWER JAW

VII. Buccal Cusp Curve
VIII. Fossæ Curve
IX. Lingual Cusp Curve
X. Compensating Contact Curve
XI. Outer Gum Curve
XII. Inner Gum Curve

Lines and curves relating to both jaws which connect points of occlusal contact are:

XIII. Outer Curve of Occlusal Contact.
XIV. Inner Curve of Occlusal Contact.

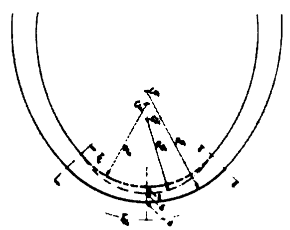


Fig. 5.

Some of these curves and their relations have previously been considered in a joint paper by Dr. F. L. Stanton and the author, presented before the Panama-Pacific Dental Congress in San Francisco during 1915. A more thorough investigation since has shown that while the observations published at that time were important steps in the development of dental surveying, they were neither complete nor were they based on unassailable hypotheses. Fig. 4 clearly illustrates the complex relation of the different dental curves in their horizontal projection.

In laying out the horizontal projection of these curves it was ever kept in mind that, aside from the tooth measurements proper, the relation of the curves in space must be considered. The projection plane very nearly runs through the contact points of the upper incisors, canines and premolars, i.e., the anterior part of the U.C.C.C.* The incisal portion of the L.C.C.C. is inclined toward the projecting plane; and in order to get correct results, this portion of the L.C.C.C. has been revolved into the plane of projection or into a plane

*For abbreviated terms see nomenclature, page 657.

parallel thereto. The dash-dotted circle with a radius, Ra, and a center, Ca, is the result. (See Fig. 5.)

This revolved arc of the L.C.C.C. may be designated as the actual arc of the lower anterior, and it is on this arc that we have to mark off the mesio-distal diameters of the lower, and not on the projection of the L.C.C.C. It has another very interesting feature; it very nearly coincides with the projection of the labial angle of the incisal edges of the lower centrals and laterals, the points of contact of the lower and upper incisors.

To facilitate the problem of laying out the teeth of the dental arch in their

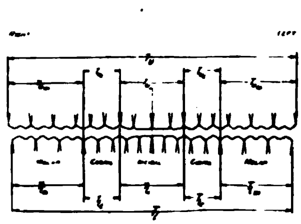


Fig. 6.

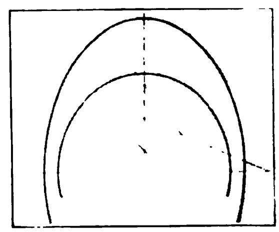


Fig. 7A.

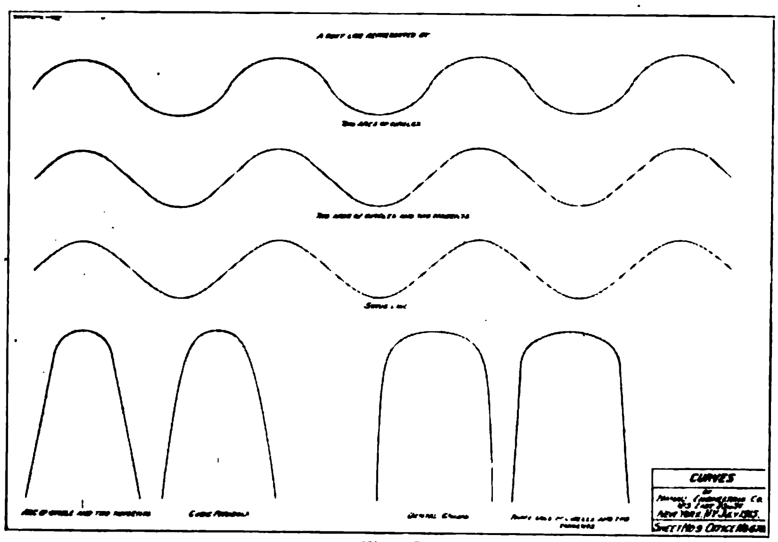


Fig. 7B.

proper relation, we have divided the denture into *five* distinct regions (Fig. 6):

I. The incisal region consisting of the centrals and laterals of the upper, and of the centrals and laterals and the mesial halves of the cuspids of the lower jaw.

II. The left cuspal region.

III. The right cuspal region.

Each consists of the canine, first premolar and the mesial half of the second premolar of the upper, also the distal half of the canine, and the first and second premolars of the lower jaw.

IV. The left molar region.

V. The right molar region.

Each embraces the distal half of the second premolar and first, second and third molars of the upper jaw, also the first, second and third molars of the lower jaw.

Each part of a C.C.C. in a region is represented by an arc of a circle, hence each C.C.C. is represented by five arcs of circles.

To substitute a curve by a series of arcs of circles is quite permissible, and does not affect the accuracy of the results nor does it mar its appearance. Fig. *7A*. shows two ellipses. The left of these ellipses is made up of arcs of circles, while the points of the right are most accurately laid out and connected by a continuous curve. There is hardly any difference to be detected between the continuity and the accuracy of either half. Fig. *7B* shows several curves and substitution by arcs and straight lines.

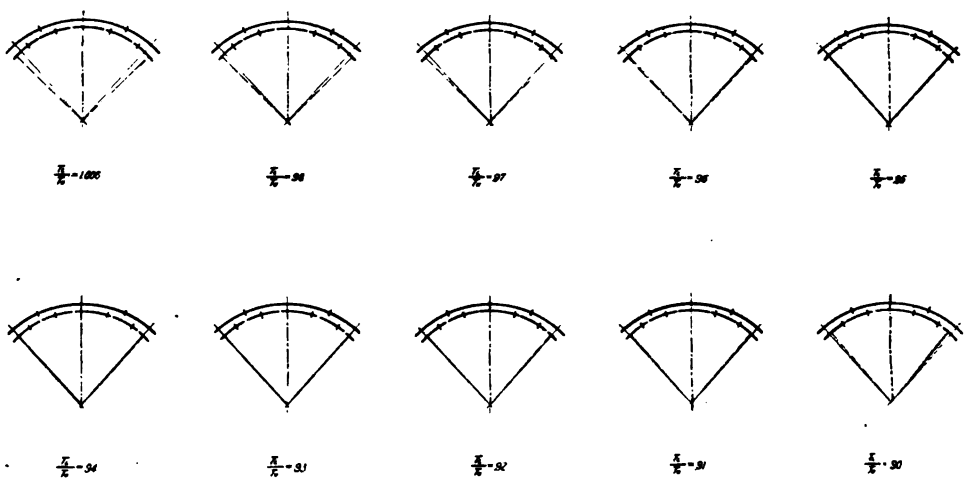


Fig. 8.

In Fig. 8 ten arches are shown. The sum of the mesio-distal diameters of the upper four anterior teeth

$$(2Cu+2Lu) = Tui$$

is considered a constant, while the sum of the mesio-distal diameters of the 2 centrals, the 2 laterals and the two half canines of the lower

$$(2Cl+2Ll+El) = Tli$$

varies. The incisal ratio

$$\frac{2Cl+2Ll+El}{2Cu+2Lu} = \frac{Tli}{Tui}$$

changes from 0.90 to 1.006.

The same arcs are used in all figures for laying out the tooth material for both the upper and lower incisors.

The figure having the ratio 0.93 shows the teeth in their proper occlusal relation; i.e., the teeth under consideration interdigitate in accordance with occlusal requirements.

Let us assume that the radius for the arc in this figure was selected according to the Hawley rule, and that incidentally it had proved correct, in so far as the placing of the tooth material on the arc is concerned. According to the Hawley rule there could be only one solution for the varying relations between upper and lower mesio-distal diameters which have incisal ratios ranging from 0.90 to 1.006. The teeth have been placed on the arcs in their adjacent position, but in juxtaposition in the upper and lower.

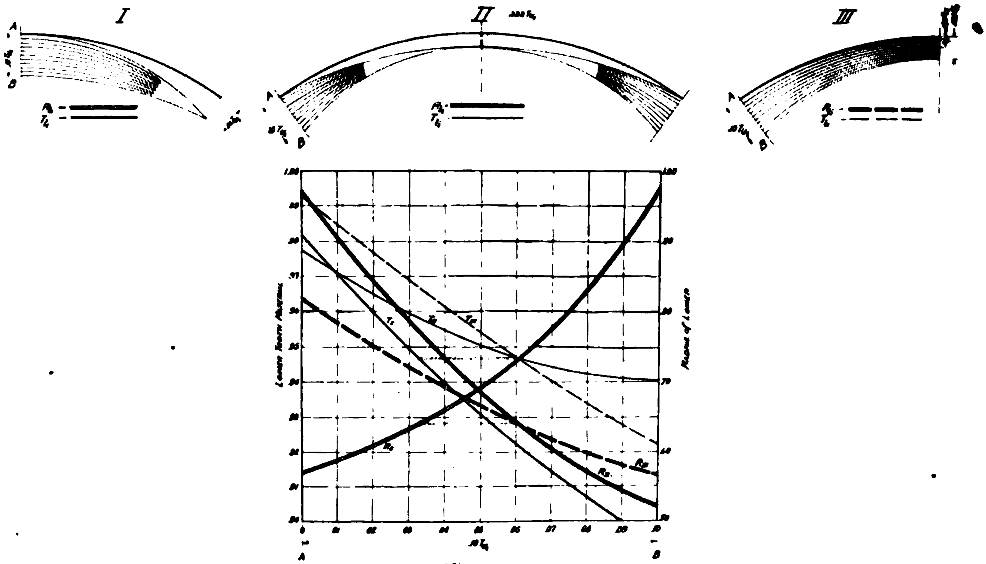


Fig. 9.

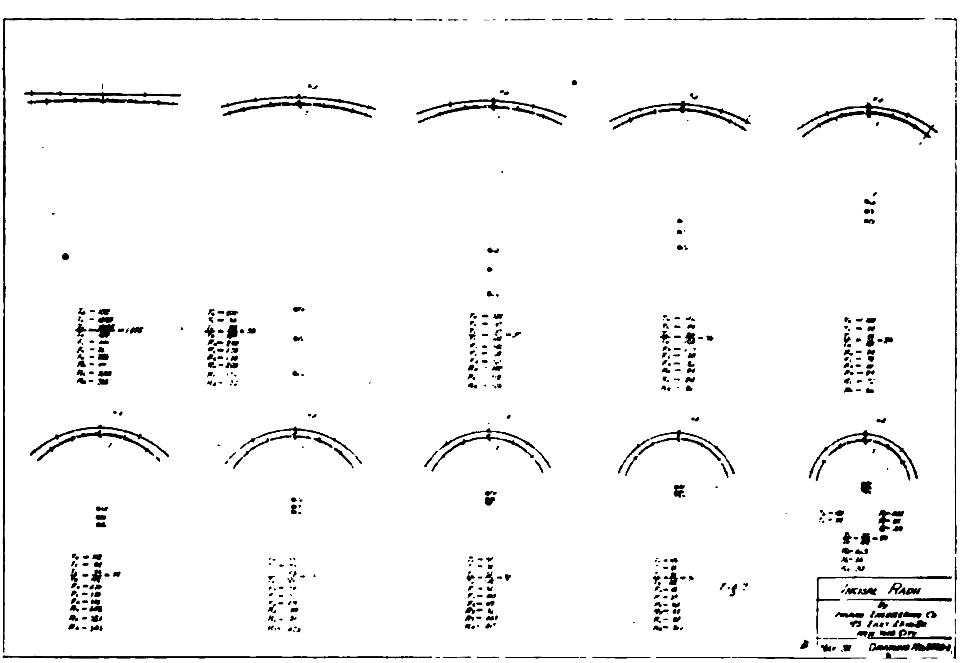


Fig. 10.

It will be observed that with the increasing ratio, the distal angles of the lower teeth are distally malposed, while in the figures where the ratio decreases, the distal angles of the teeth are mesially malposed. These figures clearly show that the Hawley thumb method is unreliable, being based on mere guess work.

In order to simplify the problem, measurements and surveys of normal dentures of the teeth have been made, and it has been found that at the apices of the arcs which represent the projections of the incisal portion of the C.C.C.'s the distance of the teeth normally is 0.045 of the sum of the mesio-distal diameters of the four upper incisors.

$$A_{ml}=0.045 \quad T_{ui}$$

(An average)

The distance of the arcs labio-lingually at the distal angle of the laterals may be assumed as 0.06 of the mesio-distal diameters of the four upper incisors measured as indicated above; i.e.,

$$A_{e}=0.06 \quad T_{ui}$$

(An average)

These values vary as they depend upon the dimensions and shape of the teeth.

The relation which exists between the labio-lingual distances at the median line, at the distal angle of the upper laterals, the tooth material, and the radii of curvature of the incisal region is shown in Fig. 9. This presents the solution of the problem of the over-bite and, as such, is of utmost importance.

The width of all teeth is represented by the mesio-distal diameters from points of contact with adjacent teeth. The broken line represented by these mesio-distal diameters throughout the entire denture, known as "the compensating contact line," has been adopted by the author for determining the occlusal relation because it is the most suitable. A curve running through the corners of the broken compensating contact line may be called the "compensating contact curve." The mesio-distal diameters of the teeth, therefore, appear as chords of the compensating contact curve.

Fig. 10 shows ten anterior portions of the C.C.C. of both the upper and lower jaws. The incisal ratios vary from 1.006 to 0.90, exactly like those shown in Fig. 8. The mesio-distal diameters of the upper centrals and laterals are marked off on the arc having the radius R_{ui}, and the lower centrals and laterals are marked off on the dash-dotted circle having the radius R_{ai}, and they are then properly transferred to the projections of the arc of the lower compensating contact curve having the radius R_{li}.

It will be noted that with increasing ratio

$$\frac{T_{li}}{T_{ui}}$$

the radii of curvature of both the U.C.C.C. and L.C.C.C., increase, and vice versa. It will also be observed that with decreasing ratio, the difference in size of the upper and lower radii decreases, and also their ratio. When we compare this drawing with Fig. 8, it will be seen that the proper occlusal relation of the anterior teeth, labio-lingually, is achieved.

The radii used for these layouts are taken from the chart shown in Fig. 11. This chart shows the incisal radii in their relation to the ratio

$$\frac{Tl_i}{Tu_i}$$

It is the result of thorough nomographic investigation.

The ratio

$$\frac{Tl_i}{Tu_i}$$

is represented on the vertical axis, while the factors, F_{u_i}, F_{l_i} and F_{a_i}, for the radii will be found on the abscissa of the coordinate system of the chart. The product of these factors and the sum of the mesio-distal diameters of the four upper incisors give the dimension of the radii.

For example, if the mesio-distal diameters of the upper incisor measure

$$2(8.9 + 7.0) = 31.8$$

and the mesio-distal diameters of the lower teeth measure

$$2(5.7 + 6) + 6.6 = 30.0$$

then we have

$$Tl_i = 30.0$$

$$Tu_i = 31.8$$

$$\frac{Tl_i}{Tu_i} = .943$$

Reading the chart we find that for the ratio .943 the radial factors are:

$$F_{u_i} = .74$$

$$F_{l_i} = .62$$

$$F_{a_i} = .58$$

therefore, the radii are:

$$R_{u_i} = F_{u_i} \times Tu_i = .74 \times 31.8 = 23.53$$

$$R_{l_i} = F_{l_i} \times Tu_i = .62 \times 31.8 = 19.72$$

$$R_{a_i} = F_{a_i} \times Tu_i = .58 \times 31.8 = 18.44$$

The distance between the apex of the U.C.C.C. and the circle having the radius R_{a_i} is:

$$.033 Tu_i = .033 \times 31.8 = 1.049$$

We begin by drawing a center line, and describing a circle with a radius

$$R_{u_i} = 23.53$$

then we measure from the apex "u" centripetally

$$.033 Tu_i = 1.049$$

and mark this point "a" on the center line. Then we mark "i" on the center line at a distance of

$$.045T_{ui} = 1.43$$

from "u" on the U.C.C.C.

It would be accidental if we should find the continuation of these curves to be a straight line, posteriorly from the canines. With few exceptions the C.C.Curve is a true curve, therefore, it must be continuous and show no sudden changes or breaks. The posterior extensions of the dental arch frequently assume an asymptotic character.

The anterior portion of the denture being settled, it now remains to investigate the cuspal and molar regions of the denture. But the cuspal regions in particular deserve most careful attention. Any error in this part of the denture may affect the anterior, as well as the posterior teeth in their occlusal relation.

Let us see what would occur if we should make an error in the selection of

Fig. 11.

an incorrect radius for the curvature in the horizontal projection of the cuspal region.

Assuming that the selected *cuspal radius (of curvature) is too small* and the lower teeth in the position selected will still be able to hold their own, assuming also, that the incisal and the molar portions of the upper arch retain their occlusal relation, then a break of the arch in the cuspal region results. If for some other reason the incisal and cuspal portion of the upper will remain in occlusal or pseudo-occlusal relation, and the teeth of the upper molar portion remain in contact with the cuspal portion, then the result will be that the lower posterior teeth will be malposed.

For the purpose of illustration let us select the same incorrect arch, and assume that the lower molar and cuspal regions retain occlusal or semiocclusal contact relation with the uppers, then a break of the upper-arch occurs within

the upper incisal portion, provided the lower teeth remain in position. When selecting too big a radius, the reverse, as explained above, will take place.

The relation between the incisal cuspal and molar portions of the denture is so intimate that it must not be overlooked. Fig. 12 illustrates in a plane the result of selecting different curvatures for one and the same set of tooth units.

Accepting the incisal region as correct, let us assume that at one time the denture is of such a nature that the projections of the Upper and Lower C.C. Curves continue in circles of varying radii from the distal angle of the upper lateral and the summit of the cusps of the lower canine. At another time on the right half of the figure let us assume that the C.C.C.'s of the upper and lower

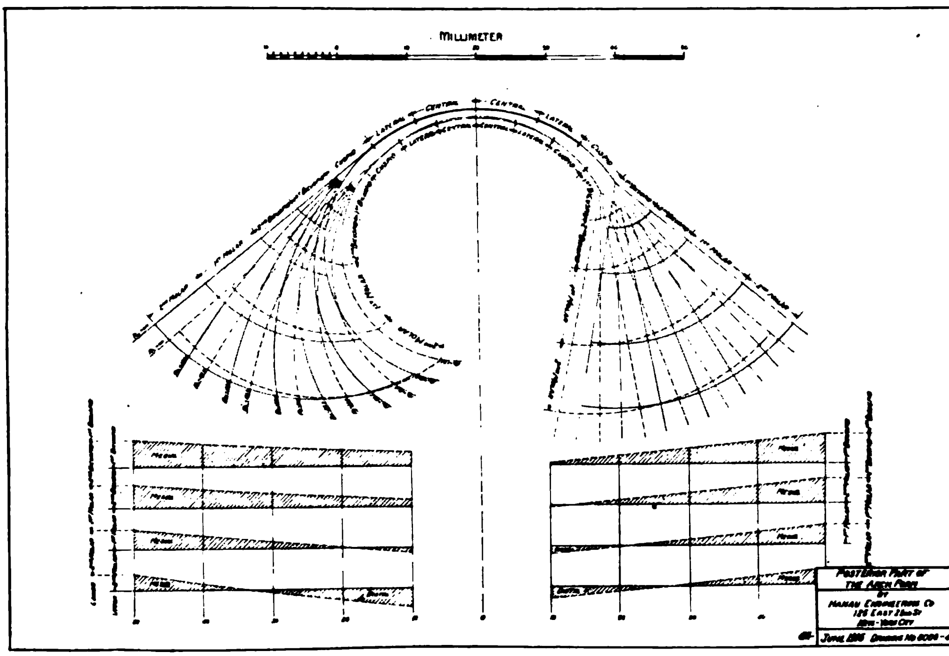


Fig. 12.

continue posteriorly from the distal angle of the upper canine and the center of the lower first premolar at different angles in straight lines. Below each half a diagram illustrates the changes which occur in the mesio-distal relation of the contact points. The bucco-lingual distances for each set of C.C.Curves are nearly constant. We may read the relation between adjacent contact points of the two jaws on verticals drawn from the distal contact points of the second molars on the diagram below. The radii change from an impossible minimum to an impossible maximum, and so do the angles of the lines on the right half of the figure.

A closer study of the figure convinces us that no one particular arch form can be adopted to be standardized for all dentures by merely providing a series of

sizes of geometrically alike figures, unless a fixed relation in the size of the individual teeth exists, which does not.

It would have been more in keeping with existing conditions if someone had introduced a shape of dental arch consisting of three arcs, one forming the apex or the anterior portion of the denture, and two extending posteriorly from the canine, having a common tangent at this point.

There is no question that such an arch form is more beautiful and resembles more closely the human arch form, and with a little pains and thought, a convenient construction thereof could be devised. Fig. 13 will sustain this claim. The Hawley arch form is shown along side with this for the purpose of comparison. Both arches possess some merit, but they are equally misleading, although the Hawley arch has almost universally been accepted as a standard.

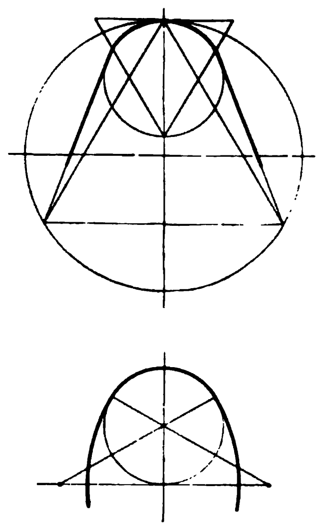


Fig. 13.

This new arch, although prettier in appearance, is not presented for serious consideration; it is solely a product of imagination.

Figs. 14, 15 and 16 represent the U.C.C.C. and L.C.C.C. in their different occlusal relations, direct occlusion, end to end bite, and lateral occlusion, each in three projections.

Other dental curves were likewise investigated and the results of these investigations were used to check up the accuracy of plotted dental arches.

It may be mentioned that the author, in the early stages of his investigation, found a general mathematical formula applicable to all dental curves of a denture in occlusion, but this is of theoretical value only.

$$y = F_1 \, (X^1 \pm y \;\; f(w))^n{}_1 + C_1$$
$$z = F_2 \, y^n{}_2 + C_2$$

x, y and z represent the ordinates in a coordinate system whose point of intersection is the apex of the U.C.C.C. The x-y plane is laid through the apex

of the U.C.C.C. and the contact points of second premolars and first molars, or better ½ mm. below the latter. The y-z plane is vertical to the x-y plane and divides the dentures anterio-posteriorly.

The factors, F_1 and F_2 express the relation of the units on the axes.

X^1 is the x ordinate of the parent parabola to which is added y f(w) when x is positive, and subtracted when x is negative.

f(w) itself invariably is negative for dentures in occlusion and mostly of simple form, in the figures f(w)=tg d.

With increase of f(w) we approach the elliptical arch form, the exponent

$$1.5 \langle n_1 \rangle \cdot 4$$

The lower values of "n" only occur together with high values of f(w). The exponent "n" indicates a parabolic character.

$$n_2 > n_1$$
$$F_2 < F_1$$

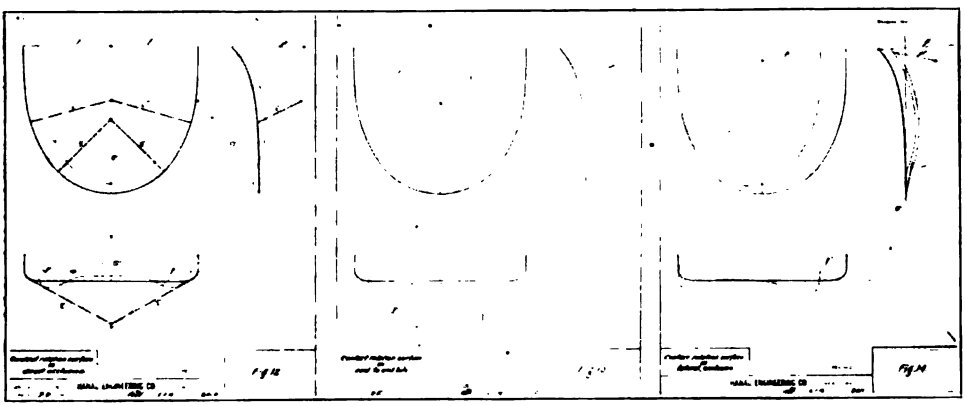


Fig. 14. Fig. 15. Fig. 16.

Curves illustrating the formula are shown in Figs. 17, 18, 19, 20, and 21.

In Fig. 17 is shown a series of curves representing the formula

$$y = F_1 \quad (X^1 + y \; f(w))^n + C_1$$

in which

$$C_1 = 0$$
$$F_1 = 1$$
$$f(w) = 0$$

while the exponent "n" varies from 1 to 8.

It will be noted that the lower part of the curves flattens out and the side becomes steeper.

If these curves were to be observed in dentures, we would say that by increasing exponent "n," the incisal radius increases, the canines become more prominent, and the posterior extensions approach the parallel lines.

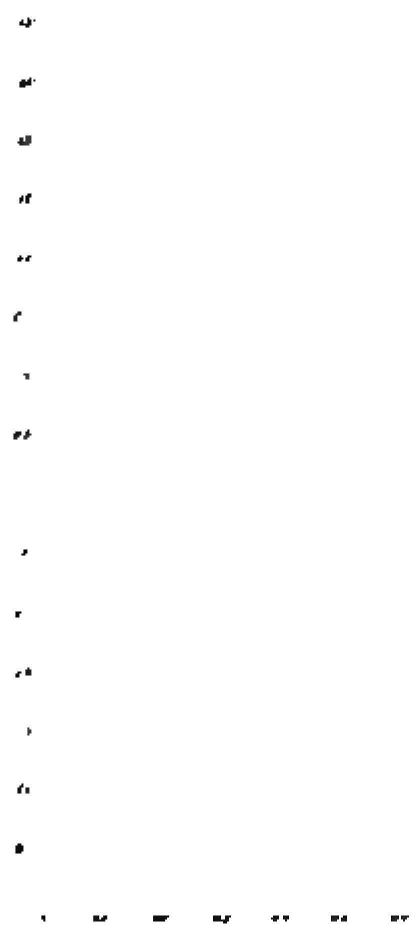


Fig. 17.

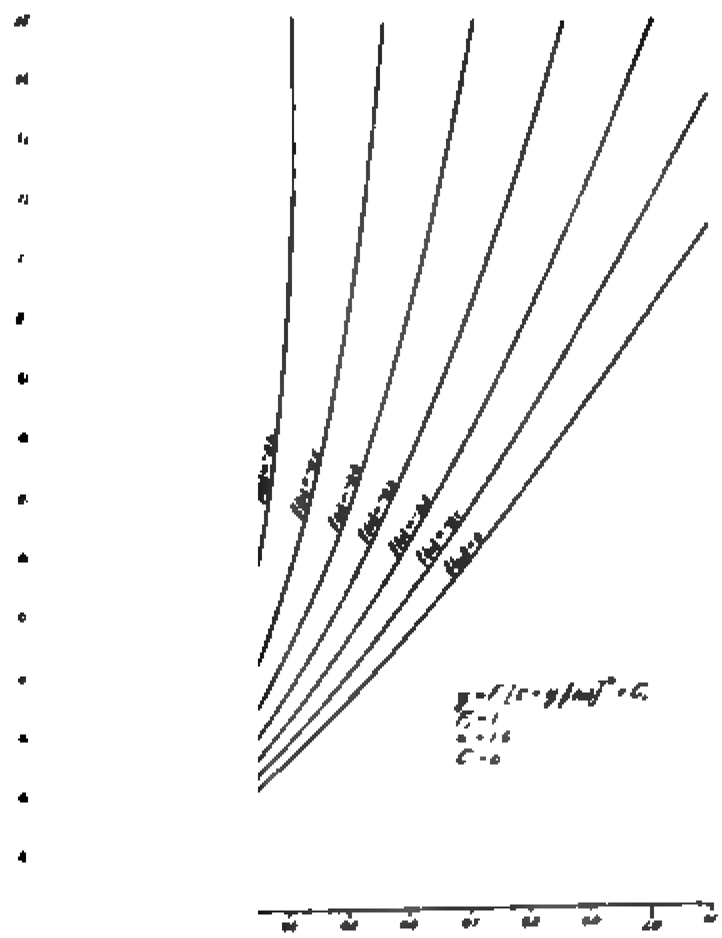


Fig. 18.

Fig. 19

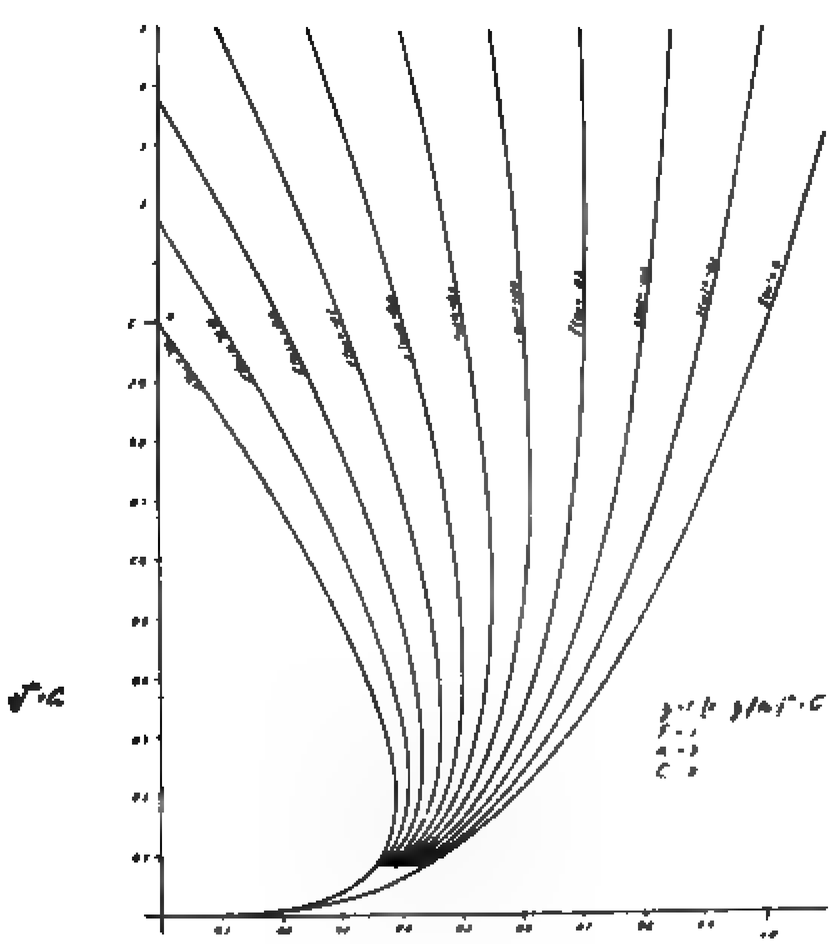


Fig. 20.

Figs. 18, 19, and 20 show curves, each for a different exponent. The different values for f(w) and n, are indicated. Fig. 21 shows curves where the exponent

$$n = 3$$

but the factor F_1 is subjected to variations. The resulting curves are geometrically similar.

Ordinarily, standardization is simple, if only one factor of the formula is subject to change; it would also be in order, if more than one factor changes, but in such cases a plurality of types must be considered, and each type should be standardized separately.

Fig. 22 is an enlarged view of a survey of a denture in malocclusion, the points were surveyed and their elevations read with the aid of the Stanton-Hanau surveying apparatus.

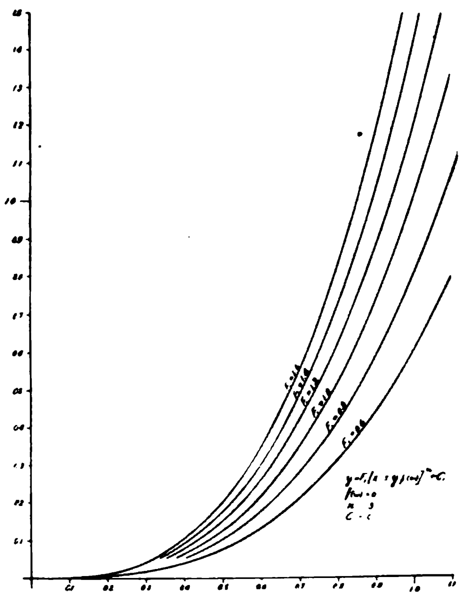


Fig. 21.

Fig. 23 shows the development of the points of the denture on a surface laid through an arbitrary arch, illustrated in Fig. 24.

In the paper read before the Panama-Pacific Congress at San Francisco in 1915, this subject was taken up.

Figs. 25*A* and 25*B* show a "photo-survey" of the same denture. By photo-survey is meant a photograph in orthographic projection. It has the advantage over the survey made on the surveying apparatus, in that it shows every detail, and, therefore, is more explanatory.

Another denture is illustrated in Figs. 26, 27, and 28 in horizontal projection and in side view. To make these photo-surveys, I designed a camera. The main feature of this camera is a peculiar combination of lenses.

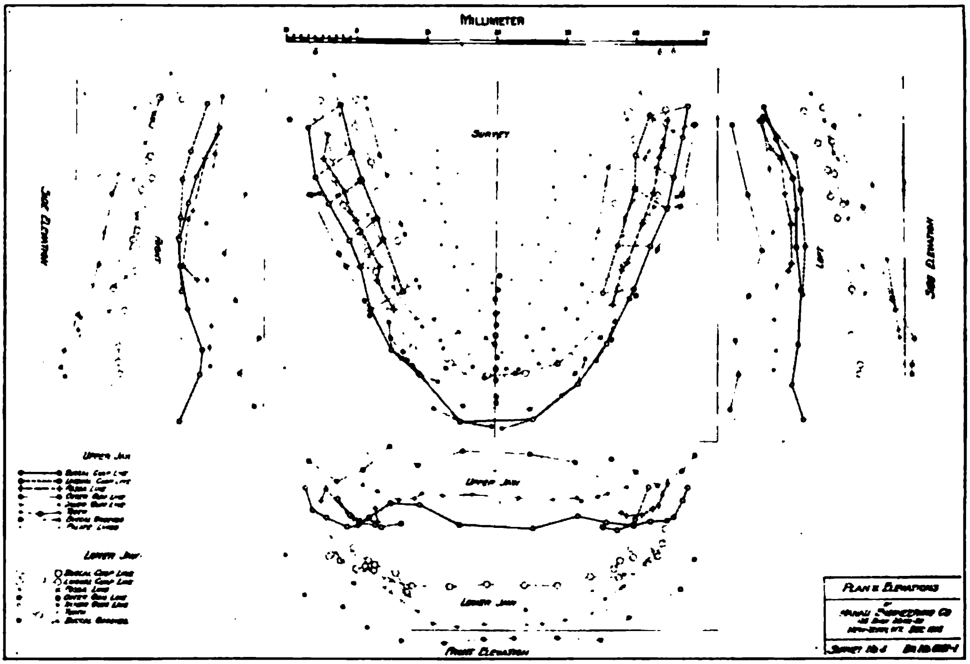


Fig. 22.

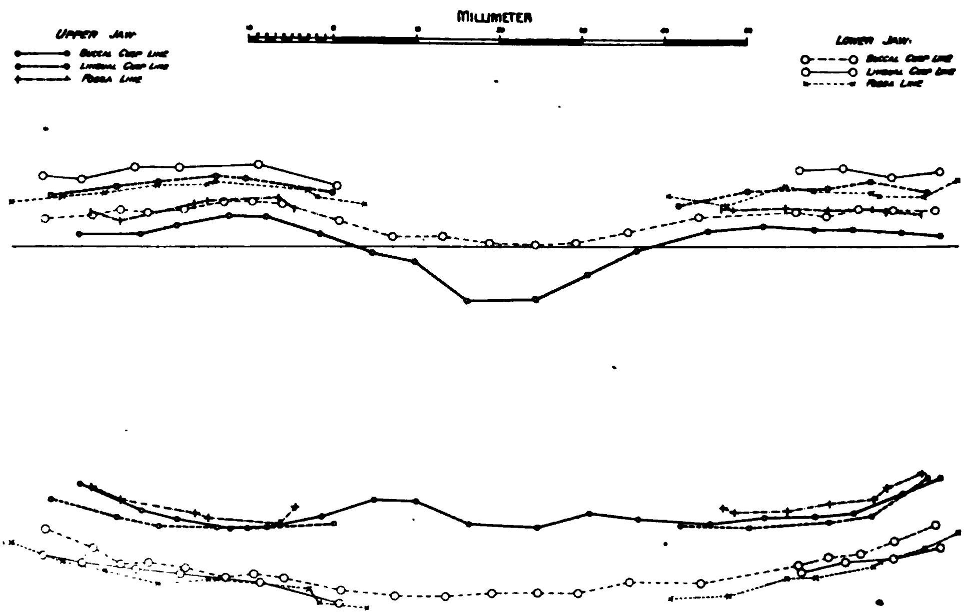


Fig. 23.

Figs. 29 and 30 show orthophotographs of a skull in both front and side views. The apparatus was not meant to take such large objects.

Fig. 31 brings before us the plan of the upper and lower denture.

The various dental curves were drawn on such a survey and were compared with Fig. 4. It proved that Fig. 4 was a good representation of the relation of the different dental curves.

The severe criticism here applied to arbitrary methods in the laying out of dental arches is not intended to belittle their originators or authors, but is designed to bring to the attention of the profession the elements of danger always connected with the application of arbitrary methods and thumb rules to scientific matters.

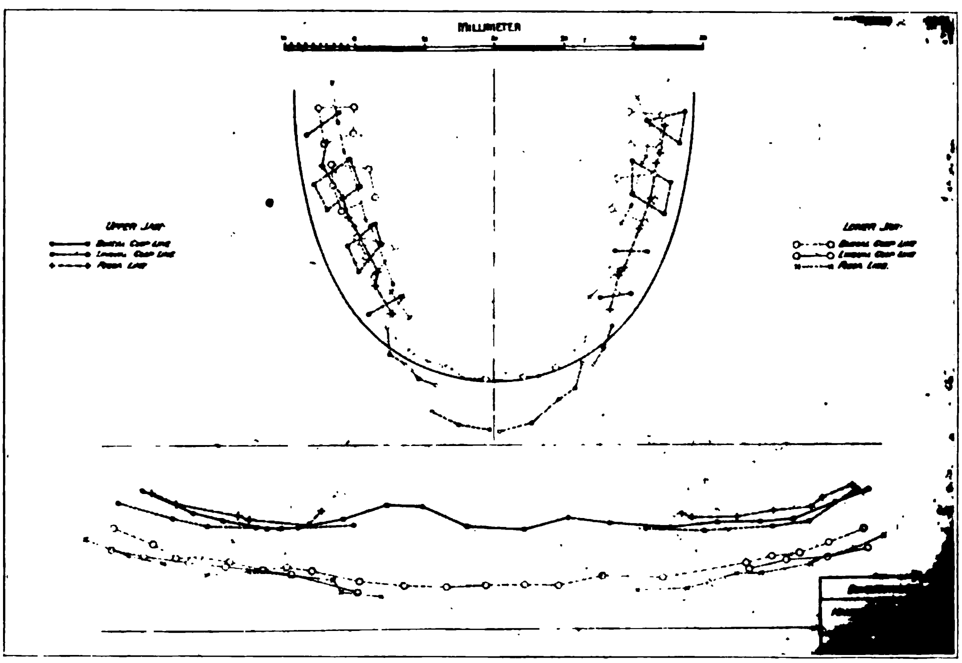


Fig. 24.

The author is aware of the existence in all scientific fields of similar evolutionary processes, inasmuch as all applied sciences are exposed, at the start, to tendencies to formulate observations of practical value into convenient and handy rules for the purpose of facilitating their application. At the same time we must ever consider that all such methods lead to approximate values, and their use can be justified only for the want of better, absolute methods.

"Thumb rules" have been, and still are, applied in all scientific fields; they were, in fact, the basis for construction in my own profession; they are, however, defensible and justifiable only if they lead to sufficiently accurate results.

Let us remember that in the laying out of the dental arch we have to deal with very small units, and that, therefore, an apparently negligible difference in

Fig. 25-*A*.

Fig. 25-*B*.

the dimensions will appreciably mislead us, and bring us to an utterly false conclusion.

Let us also consider that every individual case requires treatment absolutely peculiar to itself, for it will hardly occur in practice that two dentures are found exactly alike.

Fig. 26.

Fig. 27.

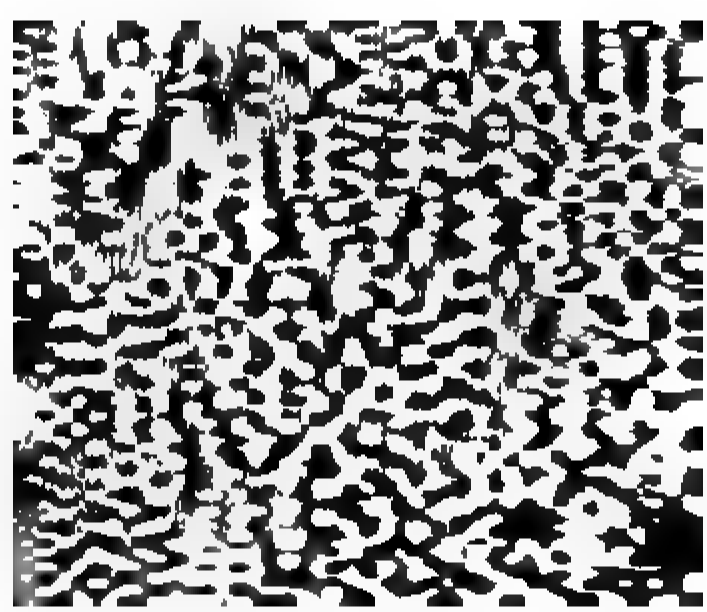


Fig. 28.

For these reasons it must be patent to all students of orthodontics that the application of arbitrary methods to a formation as complicated as the human denture should not only fail of recommendation, but ought also be discouraged, if not condemned.

Fig. 29.

Fig. 30.

Fig. 31.

CODE

Appertaining to the Mathematics of the Denture

TEETH

TOOTH	UPPER	LOWER
Central	C_u	C_l
Lateral	L_u	L_l
Cuspid (or Canine)	E_u	E_l
1st Bicuspid (or Premolar)	B_u	B_l^1
2nd Bicuspid (or Premolar)	B_u^2	B_l^2
1st Molar	M_u^1	M_l^1
2nd Molar	M_u^2	M_l^2
3rd Molar	M_u^3	M_l^3

TOOTH MATERIAL

Upper	T_u
Lower	T_l
Upper Incisal	T_{ui}
Lower Incisal	T_{li}
Upper Cuspal	T_{uc}
Lower Cuspal	T_{lc}
Upper Molar	T_{um}
Lower Molar	T_{lm}

Curves

CURVE	UPPER	LOWER
Buccal Cusp	U.B.C.C.	L.B.C.C.
Fossae	U.F.C.	L.F.C.
Lingual Cusp	U.L.C.C.	L.L.C.C.
Compensating Contact	U.C.C.C.	L.C.C.C.
Outer Gum	U.O.G.C.	L.O.G.C.
Inner Gum	U.I.G.C.	L.I.G.C.
Outer Curve of Occlusal Contact	O.C. of O.C.	
Inner Curve of Occlusal Contact	I.C. of O.C.	

Radii, Centers, and Factors

	INCISAL		CUSPAL		MOLAR	
	UPPER	LOWER	UPPER	LOWER	UPPER	LOWER
Radius of Curvature	R_{ui}	R_{li}	R_{uc}	R_{lc}	R_{um}	R_{lm}
Centers for Radii	C_{ui}	C_{li}	C_{uc}	C_{lc}	C_{um}	C_{lm}
Radial Factors	F_{ui}	F_{li}	F_{uc}	F_{lc}	F_{um}	F_{lm}

MISCELLANEOUS

Center of Revolved Curvature				
Apex of U.C.C.C.		u	Distal Angle of Upper Laterals	c
Apex of L.C.C.C.		l		
Apex of revolved lower incisal arc		a	Center of Mesio-distal Diameters of Lower Cuspids	e
Distance of C.C.C.'s at	El	Ae		
Distance u-a		Ama		
Distance u-l		Aml		
Distance c-e		Ace		

CONCLUSIONS

The dental arch form is a function of the tooth measurements (size and shape), of the relation of the teeth in each jaw, as well as in opposite jaws, and of the kinematic and mechanical requirements.

The graphic method is recommended for investigation and checking.

DISCUSSION

Dr. Kemple.—I am sure our essayist has made it very clear to everyone present here how he harmonizes the dental arches by careful mathematical computation of the amount of tooth material involved. I want to say in the very beginning, for the benefit of our essayist and also for our members, that this society is very much interested in the scientific side of this subject. We want to learn all we possibly can about predetermining the dental arches. If we can learn that, we will feel more than repaid for the trip to Pittsburgh, and some of our members have come great distances, from Washington, Oklahoma, etc.

We want this discussion to be carried along on perfectly scientific lines, and I am very glad to have an opportunity to ask Dr. Stanton to kindly open the discussion on this paper.

Dr. F. L. Stanton.—I think this is probably the most important paper ever presented before this society. When you, as orthodontists, realize that the occlusion of any individual tooth can be predetermined, and shown in relation to maps of the malocclusion, you will agree with me in regard to the importance of this subject.

At various times during the last two years I have endeavored to show several of the members of this society the necessity of considering the denture in three dimensions, and am glad to see Mr. Hanau has so successfully held your attention. He, as an engineer, has done conscientious work.

I will outline my connection with this work. In the fall of 1914 I was so displeased with orthodontia in general, and myself in particular, that I decided that unless I could place the whole matter on the drawing board and see what I needed to do, I would abandon orthodontia. From October, 1914, until the spring of 1915, I made maps of models of malocclusion by means of calipers and bisecting lines. Maps were made of dentures in the various types of skulls at the National Museum and at our Museum at New York. In the spring of 1915, seeing the necessity of considering the third dimension, and desiring to have an instrument constructed that would record the relative heights of the denture, I consulted engineers and selected the essayist, who constructed the dental surveying apparatus. From the data I had collected, the essayist devised the mathematical predetermination of the arch as related in the San Francisco paper.

In the fall of 1915, being desirous of having the work checked to date, I consulted the engineering department of Columbia. In two weeks I received an indorsement, saying it was correct to make maps of malocclusion, but a much simpler method of predetermining the occlusion mechanically was devised by Mr. Gilbert D. Fish, which method I shall demonstrate at my clinic tomorrow. A paper has already been prepared describing this method.

I am sure what you have heard tonight will change the practice of every man in

this room and childhood will be better served the world over as a result of this paper. I thank you all.

Dr. Hawley.—Mr. President and Gentlemen: I have listened to this paper with much pleasure, but it would have given us more pleasure if some parts of the paper had been read, because Mr. Hanau did not read all the criticisms made of my arch. I do not know if the reason is that I have become acquainted with him since he wrote it, and he does not want to hurt my feelings! My feelings would not have been hurt because all the defects of that arch he has named I have admitted again and again publicly. The situation relative to those arches, and what I comprehended of this paper, is this: In the first place, when those were drawn there was a very little accurate comprehension of the size of the dental arch; i.e., the positions in which the teeth would be, and I attempted from the measurement of the teeth to produce a Bonwill arch. The arches produced and placed on the chart were Bonwill arches, and they were accompanied with the general criticism of those arches, which I stated were true. Mr. Hanau has criticized them. They did not represent the exact position of the teeth in the mouth, because the molars were always lingual from the straight line backward of the cuspid; but they did give a fairly accurate conception of the width of the arches corresponding to size of the teeth. The conception I had gained previous to this, and which was common to most orthodontists, was that it was possible to make a perfect occlusion of the teeth if one had sufficient skill. In other words, that the tooth material in the upper and lower jaws was harmonious and constant. You get that taken out of your mind after you measure teeth awhile. As soon as I began to draw arches of the upper and lower teeth and tried to fit them together, I saw it was a mistake and that was admitted in my second paper and advised against, and the whole matter of the use of that arch is simply an approximation.

Now there was a lack of harmony in the upper and lower arches and that was caused by the inharmonious amount of tooth material in the upper and lower arches, and this is most common in the incisal region. This problem I have never been able to work out.

As I can see Mr. Hanau's paper, he has worked out the relation of tooth material in the upper and lower teeth so that you know the exact situation, and I do not question at all his results. There is no one who views his work with more pleasure than I do, and no one that accepts more freely than I his criticisms on these arches.

Now the question comes up in my mind, and probably in yours, just how practical this is and just how much will it modify our work. Dr. Stanton is enthusiastic, and is of the belief this will revolutionize the practice of orthodontia. I am not so enthusiastic about that. It will solve a problem that has not been solved before. Mr. Hanau is an engineer and he admits that he does not know very much about orthodontics nor has he experience in the kinematics of orthodontics. I stated to him the problem of the relation of the two lines formed by the measurement of the tooth material in the upper and lower arch, and he agrees with me. If we accept the arches he draws, and accept them with the interpretation that Dr. Stanton makes, we might have an amount of tooth material that would make our curve almost a straight line. Suppose I would give him the measurements of the teeth in a certain type of patient; for instance, a type of head which is long and narrow and a face long and thin, and he would tell me the tooth material in that face, or the relation between the amounts of tooth material in the upper and lower jaws was going to indicate a very wide, flat arch in the anterior region: I would tell him I would not do it, but that would be just as valuable to me because he would indicate to me what I could and what I could not do. That is, suppose I say, from the type of the individual and what I conceive to be an artistic result, what will conform to the anatomy and type of the head,—I want to produce a certain arch. He will tell me exactly how much tooth material I must sacrifice in every arch. If he would tell me to widen the upper teeth and make spaces between them, I would say I would not do it, possibly, but he could tell me, on the other hand, that possibly I would have to reduce the tooth substance in the lower jaw and I might decide to do it. So while there are things which will modify it in practice, the arches which he would indicate to me are possible for normal occlusion. I might say I could not do that in that case; but he has solved a problem I could not solve, and I am especially pleased with the manner in which he presents it to this society. His attitude is that of an engineer: our attitude is that of the working orthodontist, and we may arrive at different conclusions. So far as revolutionizing our practice is concerned, you are going, in the use of these arches, to meet exactly the same problem I did in guessing at arches. When I had all the tooth material, I could measure them and arrive at the

proper measurement; but, in 75 per cent of the cases we treat, we do not have all the tooth material. We do not get the canines until 12 years of age, etc. We must treat cases before that age and we have to depend on an *accurate cast*. So far as being able in all cases to absolutely predetermine the arch, I do not see how we are going to do that, and we are left in 75 per cent of cases very nearly where we were before. I do not mean to detract from the value of this work, but to clearly distinguish the situation and the problem he has solved. I have found some cases, and some have been brought me where, so far as we could measure and determine and lay out, it was impossible to get the occlusion of the molar and premolar teeth without producing an under-bite. There was too much tooth material in the lower arch or jaw. In some of those cases I have extracted the lower incisor and produced a normal over-bite and normal occlusion of the molar teeth. That was not my former conception of the harmony in the human denture, but I feel certain it is absolutely true. Mr. Hanau can make an absolute survey with this process, of the conditions there, and have something definite on which to base work in practice, and in that way especially it is extremely valuable.

It seems to me there are some things here proposed that may be indicated in the formation of the curve of the mouth that may be difficult and impracticable to produce, but I would like to try it even yet. I feel greatly indebted to Mr. Hanau and am very much pleased at his presentation of the subject.

Dr. Ottolengui.—I would like to ask Mr. Hanau a question. I thought we were going to have explained to us a method of predetermining the arch form, and I have listened with much interest and think I have understood a little of it, but all I can get so far is the predetermination of the arch form in the anterior region. The question I want to ask is: "Have you worked out a solution of the whole arch form?" It seems to me this is rather a fragmentary presentation.

Mr. Hanau.—I have worked out a method for the entire arch form.

Dr. Ottolengui.—You showed on the screen some orthodontic projections of models of mine that I had loaned to Dr. Stanton, and you did not present any arch forms for that case. When you spoke of missing tooth substance, I thought you were talking of that case because that is the only case I remember about, and in that case apparently the lateral and cuspid on one side are considerably smaller in diameter than the lateral and cuspid on the other side, for which, if I remember correctly, Dr. Stanton suggested it would be necessary to have the median line a little bit off. Another point not very clear is, it seems to me you have not given us any formula for really making the arch form nor shown any predetermined arch forms that you have, and you have not made it clear to me and neither did Dr. Stanton. I want to say on behalf of Dr. Stanton, I think he very patiently undertook to instruct me in this matter, notwithstanding I advised him I thought I would be a very poor pupil and I do not believe I ever did grasp what Dr. Stanton tried to teach me and I do not grasp it now and I must make a *foolish* (?) statement when I say that in none of this work, as I understand it, do I see anything about the occlusal plane. It does seem to me that Dr. Stanton said if we understood it we would not attempt to elevate the teeth; and I believe that is one of the most important factors in the retention of the teeth,—to get the correct occlusal plane. That is as important as to get the correct arch form. I must confess my inability to grasp that part of it in either your paper or in anything Dr. Stanton has told me.

Mr. Hanau.—The relation of the teeth in the molar and canine regions is similar. Only the contact relation surface has a different pitch, while in the front the compensating contact surface has an incline antero-posteriorly, on the sides it has an inclination linguo-buccally. So if we apply the same method (the ratio of lower tooth material to the upper tooth material) it can be charted out according to the same principle.

Dr. Young.—I have listened to this paper of our essayist with a great deal of interest and a great deal of pleasure also, and the point that strikes me in regard to this question is its real practical value to the orthodontist. I am convinced, after going over Mr. Hanau's paper several times, that he has proved very conclusively that owing to the variation of tooth material in the incisal region of the lower and upper that the dental arch will vary in its width. In other words, if the lower tooth material in the incisal region is brought in further to get those teeth into occlusion, we must have a wide dental arch in the anterior region. If, on the other hand, the lower tooth material is narrow in its relation to the upper, then the dental arch should be considerably narrower. That is where Dr. Hawley's scheme seems to be decidedly at fault; because, as Dr. Hawley

has said for a good long time, there was not a constant relation of tooth material in the lower and upper dental arch; so he simply took the upper to serve as a guide to make the arch from that. Dr. Hawley has made a statement tonight about not being able to establish normal occlusion, owing to too much tooth material in the lower. I would like to ask Dr. Cryer, who has had much experience in examining skulls, if he has ever run across a skull with normal occlusion of the teeth in the premolar and molar region, with the incisors absolutely end to end, striking one on top of the other?

Dr. Cryer.—I think I have, and believe I can produce skulls in which bicuspids, or premolars, are in typical occlusion with the incisors, meeting edge to edge similar to the incisors of the dog.

Dr. Young.—That was the point. I remember two cases before I really knew what the occlusion of the teeth was, where the patients seemed to have beautiful occlusion of the molars and premolars and the incisors were end to end and worn perfectly flat; I believe that is normal occlusion for that type of individual, and I think it a mistake to extract incisor teeth for that individual to establish an over-bite in the incisor region.

I would like to ask Mr. Hanau a few questions. Given a set of models with all the teeth except the third molars in eruption, would you be able from your tooth measurements and your mathematical calculations to determine the exact amount of over-bite that should be established in that particular case?

Mr. Hanau.—If I understand the question, you have a certain amount of tooth material in the anterior part of the denture. Are we able to determine the exact over-bite necessary for that particular case? I have to make an assumption, if the lingual parts of the upper teeth are not of such formation that they clearly indicate where the edges of the lower should strike the lingual surfaces of the upper, but if those points are pronounced, I naturally have the solution, provided the tooth material is in harmony. I also have to consider the proper occlusal relation of the lower on the upper surfaces. If you can give me any law for the correct occlusal relation of those teeth, then I will give you the exact curve which is required to bring those teeth within the law which you, as an orthodontist, have given me. Can you give me a law or rule?

Dr. Young.—I can not. Here is the next question. As Dr. Hawley says, in 75 per cent of cases we have not the premolars nor methods to measure from. I may have four incisors and four first molars. It is practically unnecessary to ask that question, because if you could not do it in the previous case with all the tooth material to measure from, you can not in this.

* * * * * * * *

Dr. Young.—Gentlemen: The most important part Mr. Hanau has brought out in this paper tonight is what he calls orthophotography. It seems to me if he can develop a lens (and I do not see why he can not) that we can take these photographs in such a way that we absolutely eliminate the necessity of surveying models and not only will that be of interest where we want to determine what shaped dental arch we are to establish, but in all our illustrations in publishing papers. I was much impressed with these orthophotographs. As I said, I can not see the very great value with Dr. Stanton, that we will get out of this work, inasmuch as we have to do so much assuming in treating so many of our cases with mixed dentures.

Dr. Lischer.—I shall begin by asking Mr. Hanau a question. Assuming that you can make an accurate survey of the dental arch, I would like to know whether it can be made of a deciduous denture, of a permanent denture, and of a mixed denture?

Mr. Hanau.—Of all of them.

Dr. Lischer.—Very well. Now, if we make such a survey, will it reveal any facts as to *the relation of the dental arches to other anatomic landmarks of the skull?*

Mr. Hanau.—That is very important also.

Dr. Lischer.—Now suppose you could accurately determine that relation at the early age of, say, eight years, we are still confronted by the fact that this relation *changes constantly during the period of growth.* I happen to remember that several years ago Angle read a paper before this society in which he claimed the mesio-distal position of the upper first permanent molar was a fixed one, and I also remember that his hypothesis was not only violently attacked by numerous writers, both here and abroad, but at the Fiftieth Anniversary Meeting of The Austrian Dental Society (November 14, 1911), Dr. Otto Zsigmondy, of Vienna, read a paper *On the Growth of the Upper Jaw* in which he presented two very beautiful plates showing the occlusal view of the upper dental arch

in six skulls of various ages which definitely disproved Angle's contention. In each skull he drew a sharp line from a definite point on one zygomatic arch to a similar point on the opposite zygomatic arch. In the youngest specimen this line fell between the first and second deciduous molars. In the next, the second deciduous molar is shown half way to the mesial of this line. In Fig. 6 the line falls between the second deciduous molar and the first permanent molar. In Fig. 8 the dental arch has so far moved forward that the line falls between the first and second permanent molars.

In view of such tremendous changes, due to growth, what is the use of predetermining an arch for a patient of seven or eight years, but who will be under treatment and observation until twelve or fourteen years? And during all that time his denture is changing its relation constantly to other anatomic landmarks of the skull; and that relation must concern us if we become so ultraaccurate.

Don't misunderstand me; I don't want to undervalue certain mathematical methods and their possible application to lesions of the human body. I think Mr. Hanau's efforts in this direction merit our highest praise and admiration. He has delved into his tasks with a thoroughness and enthusiasm which few men possess. Besides, in optics, for instance, such researches may prove of the highest value. But I am still unconvinced as to the practical application of the results he has so far achieved, especially if we keep in mind the changing relations to which I have referred.

Mr. Hanau.—I can answer that only in part. You change your glasses constantly due to the hardening of the lenses of the eye. It is due to a physical change, and by physical means is corrected. You say you assume a line. If you permit me to assume any line then you give me a basis from which I can reckon, and if you say you want to know the relation of the growth or the relation of all the changes which have occurred in those years, to that line, that is the easiest thing in the world; because you will have this result: After six years, this tooth is here; after seven, here; after eight, here. So we can put up lines of travel under which the teeth have changed their position with relation to this line. I might as well measure everything from the center of the earth. That would be more correct, as the sea-level is not always the same distance from the center of the earth.

Dr. Lischer.—Anthropologists have agreed on a number of very definite points on the cranium of man, but it is difficult, if not impossible, to find a fixed point on the head of a growing child. But even if we could, what is the use of such a survey if the dental arches continually change their anatomic relations during the period of growth?

Mr. Hanau.—Say for instance we keep the relation of the front part of the denture and the inclination of the denture to a plane. If you can determine that plane or assume it (and men who dwell in that line of science are satisfied with locating it) I am satisfied that we can locate the apex of the denture. I could then show the relation of all the teeth in their relative position, in their line of travel. We could determine the relation between the apex of the denture and your plane. That can be done.

It was never my intention to bring nature into mathematical lines, but to accommodate mathematical problems to nature. I look for some formula that will picture nature as correctly as possible. Nature when not disturbed works best on mathematical lines.

Dr. Federspiel.—According to your ideas you can measure this by a two foot rule. You attempt to predetermine an arch when you have malformed teeth, as in rickets.

Mr. Hanau.—I do not care whether you put bricks there or teeth, I will give you a formation which will take care of these units. If the units are malformed, the resultant will be malformed. Should you follow the lines of good judgment and not the lines of nature? I call judgment guess work if it has no scientific foundation, but if we honestly say where we guess, it provides a basis for further work.

Dr. Stanton.—The gentlemen are not dealing quite fairly with the engineer and he is using the word "guess" and does not mean it. I am very familiar with Mr. Hanau's work. He means that, given an individual with teeth susceptible of occlusion, he can predetermine the arch. If there are teeth such as peg incisors, etc., he can not predetermine it because the arch is not susceptible of being put in occlusion. As to the temporary denture, no matter how it travels in relation to the skull, the moment you tell him what the normal occlusion is for that age he will predetermine the arch if the teeth are susceptible of occlusion.

Dr. Federspiel.—Where we have malformations of the jaws, as in micro- or a macromandibular curvature, how would you establish the correct occlusion?

Dr. Stanton.—The problem that the engineer solves is: given a set of teeth in malocclusion, it is possible to predetermine the form and dimensions of the normal dental arch. If you had a patient come to you at fifteen years of age, with normal occlusion and you made impressions, and then at 20 years he returned with a pronounced malocclusion, Mr. Hanau could give you the form of the arch you took at 15 when the patient had normal occlusion, by using the models of malocclusion.

Dr. McCauley.—Under the conditions mentioned, a denture susceptible of normal occlusion, Dr. Stanton states the engineer can predetermine the positions of these teeth. Can he predetermine the tooth curve and over-bite by mathematical means?

Dr. Stanton.—I can.

Dr. McCauley.—Can you without knowing the condyle path?

Dr. Stanton.—I can.

Mr. Hanau.—If your predetermined arch does not fulfill those requirements in the relation to the skull, then your predetermined arch is incorrect. You must then consider means to lay out a different arch. You can place different sized tooth material into the same arch form.

Dr. Kemple.—I believe the point Mr. Hanau wishes to establish is this, that given two amounts of tooth material, a certain amount for the upper, and a certain amount for the lower dental arch, no difference how much it is, it is possible for him to form through mathematical calculation, two curves which will harmonize. I just want to say a word on this subject myself. I have no doubt as an engineering proposition it is perfectly possible if these teeth were set in putty or in some medium in which you could move them to any position you wished them to occupy; but those teeth, gentlemen, can not be moved in any direction at will. Just one incident that will explain my meaning more clearly. I was going over this subject one afternoon with Dr. Stanton and he handed me a set of models and asked me to give him a diagnosis of that malocclusion. It was such a set as I would heartily diagnose as subdivision of Class II, in which the molars, according to my way of diagnosing the condition, together with the premolars of the right side, were in practically normal mesio-distal relation. They must have been normal in relation to some given point of the skull, but the upper and lower premolars were in normal mesio-distal relation. I told Dr. Stanton, in answering, what I would do in that case; that I would do so and so with the teeth on the left side. As to the right side I did not know I would do anything with it particularly. I thought I would not disturb it much. He asked in what direction that lower first permanent molar should be moved. I said I did not believe it should be moved at all. He said, "All right." He said that lower first permanent molar should be moved distally its full diameter. I said, "All right, let us see what is the full diameter of this lower first molar." We measured it, and as I remember, it measured 8 mm. or more. I said, "All right. According to your chart, and according to this method of predetermining that arch, in order to place those teeth in normal occlusion, you must move that lower first molar distally its full diameter,—more than 8 mm." The second molar was fully erupted. I said, "Dr. Stanton, if your charts show that those lower molars should be moved distally their full diameter, I would not give fifteen cents a carload for the machine that charts that kind of normal occlusion, because God Almighty himself could not move those teeth distally." That was my feeling in the matter. I have that feeling, gentlemen, I can not help it. I spent two or three hours with Dr. Stanton one evening going over this question. I have read Dr. Hawley's paper and have gone over the drawings, and am frank to admit I can not understand the intricate mathematics of the question. I have listened with considerable interest to this paper, and the more I hear of it, the more I fail to see there is one iota of practical value to the orthodontist in it. I do not see how it will simplify our treatment one iota or benefit the orthodontist in the slightest. If by charting these arches in malocclusion we are asked to do impossible things, what is the use? It is an interesting mechanical problem and all that, but what is the use? That is my feeling in the matter.

Dr. Bogue.—I do not know but Dr. Kemple and Dr. Lischer have answered the very question I have wanted to ask. I do not understand English very well myself, and therefore I do not know quite what is meant by the "predetermination of the arches." A determination of the arches I understand. A predetermination means a determination beforehand. A determination beforehand of what? What the arches are, or what they are going to be, or what they can possibly be made by some power outside? May I ask those questions?

Mr. Hanau.—I was fully expecting that in some way I would be misunderstood. Your president has brought out the point in which I knew I would be misunderstood. I do not want you to go into mathematics. I want you to know what you are doing, and some of you do not know. I mean so far as the shape of the denture is concerned. From almost every one of those gentlemen with whom I have had the honor to speak, I have learned there was much I did not know, and every time I had a conversation with one of the gentlemen I found something new. I have learned tonight from the questions which have been asked me. The only object of my paper is not to press mathematical formulæ on your minds or let some genius make rules to impress those formulæ. You should know what geometric relation exists between the individual teeth of each individual jaw and of both jaws, and if you understand that relation perfectly you will be able to make such changes as are necessary, and you won't apply guess work. That is actually what is being done! "I will get the canine a little further out and see if it fits." But if you know beforehand, that if you move the canine buccally, such and such conditions will occur, you will be able to analyze what you are going to do before you do it and not wait until you get results you did not expect. The results may sometimes be caused by ignorance. If you know the interrelation of the teeth, I do not see how you, with your knowledge of orthodontia, would not go many steps higher in your profession. You must have the understanding for it. *That is the object.*

Dr. Bogue.—Our friend Carl Case was here yesterday. We happened to run across the same patient. The patient came to me first. I was absent and she went to Dr. Case. He took hold of the case and very admirably corrected the malocclusion. Out of interest in the mathematics or mechanics of the case I set to work to see what teeth needed moving, and how few teeth did need moving and in what direction they needed moving to accomplish the results, and my results on the plaster models were such that I moved only four teeth in the lower jaw and I think eight in the upper; and, by the way, I did not undertake to move any upper teeth backward! My young friend, Dr. Cryer, has taught me better than that! Neither did I undertake to move any lower teeth backward! But I did move these plaster teeth buccally on one side below, and above—never mind where: where I saw fit! By moving these few teeth, I got admirable results on the plaster models. I will send a duplicate model on to Dr. Case that he and I may compare the methods that we used. He got results on the patient.

The reason I brought this case up was this! Dr. Stanton invited me to his house one night. I found he was mathematically (with this same gentleman I presume) working out that very selfsame idea. Now comes the other question, of Dr. Lischer, of what was going to occur, and he asked I think, of Mr. Hanau, whether he could predetermine from the arches containing a mixed denture, what was to come later; whether he meant what was to come by keeping your hands off or whether he meant what was possible if we took the proper steps, I do not know.

Dr. Lischer.—Either way. It would not make any difference.

Dr. Bogue.—It would make considerable difference I think. If predetermination of the denture shows it is coming all right, we do not want to touch it, but if it shows us the material is there out of which the arch may be built and it is not coming right, then we would like to know that. But I found that the exceptions to normality were sufficient to offset the relations which might be mathematically calculated. I find, for instance, in certain physical conditions, instead of having ordinary laterals we will have a peg, and so I failed to understand both what Dr. Lischer asked and what he implied in his question, and I want enlightenment.

Mr. Hanau.—I might mention one thing more. I will show you the orthophotographs. If the relation of those lines and the tooth movements are fully understood, so far as the mechanics are concerned, there is no question but that this work should be an aid to you. I have applied pretty severe criticism, especially to the work of Dr. Hawley. I did not do that to belittle his efforts. I am most thankful to him because his paper really was the paper which woke me up. I did not know anything of orthodontia before, and after reading his paper I saw there was something wrong. I became interested in it, and I taught it to the men, so far as the engineering part is concerned. Dr. Stanton had some other gentlemen very much interested in it and I thank those gentlemen for listening to me: Doctors Ferris, Murrless, Crosby and others. They have listened to me and were instructed by me and they have given me many new thoughts by their questions and their answers. I want to warn you not to use any rules of thumb unless you know the principle involved, and unless you

know what will be the consequences of the plan laid down. If I have accomplished that, and if I succeed in interesting you gentlemen and have your aid in carrying on this work along the lines suggested by Dr. Lischer (there will be an end to it unless there are results), I will be well pleased. I thank you.

Dr. Kemple.—I am sure this has been a most interesting evening and I am going to entertain a motion that the society express to Mr. Hanau its unanimous thanks for the trouble he has taken to come here and give us this paper: and also to Dr. Stanton for coming out here and opening the discussion on the paper and giving you a demonstration tomorrow.

A CASE FROM THE PRACTICE OF DR. HAWLEY, SHOWING INHARMONY IN SIZES OF UPPER AND LOWER INCISORS

By Martin Dewey, D.D.S., M.D., Chicago, Ill.

WITH the advance of the science of orthodontia and the study of the teeth along the recognized line of practice in the consideration of normal occlusion, it is found that desirable results may be obtained in all types of malocclusion. While it is possible to obtain normal occlusion in the majority of cases, it has been found in late years that there are certain conditions which render the establishment of normal occlusion from the standpoint of greatest efficiency not always possible.

So far as we know, the first case to be reported in which there was a discrepancy or difference in the size of the upper and lower teeth to such an extent that it rendered the establishment of normal occlusion impossible is the case reported by Hawley which is shown in this article. The case may be briefly described as one in which the lower incisors were of such size as to be out of proportion when compared to the size of the upper incisors. As the results of this disproportion in size it was practically impossible to establish a normal occlusion, with a sufficient over-bite. By examining Fig. 1 it will be seen that the molars and premolars possess a normal relationship.

Fig 1.

Fig. 2 shows a front view of the case, which, if carefully studied, will probably suggest that something is wrong, owing to the fact that there is such a decided bunching of the lower incisors and comparatively little bunching of the upper incisors, or what amounts almost to a protrusion.

Fig. 4 shows the occlusal view of the case before treatment. Fig. 3 shows the occlusal view of the lower arch. As the result of careful measurements and study of the teeth made by Hawley he decided that it was impossible to maintain a normal mesio-distal relation of the arches in the molar and premolar region and have a proper over-bite in the incisor region. We realize that the question of over-bite in the incisor region has been and is yet more or less of a disputed point, and what would be considered as a normal over-bite by one

Fig. 2.

Fig. 3

Fig. 4.

Fig. 5.

Fig. 6.

operator might not be so considered by another. However, by careful consideration of his case, Hawley decided that one lower incisor would have to be extracted in order to obtain an over-bite in the incisor region that would anywhere nearly perform a normal function. The result of this treatment is shown in Fig. 5, which is a side view of the case. Fig. 6 shows a front view with the missing, or extracted, lower incisor. It will be seen that one lower incisor occludes exactly between the upper centrals, or that the three remaining lower incisors occupy a relative position to the upper incisor that is usually occupied by the four lower incisor teeth. Fig. 7 shows the case after treatment. Fig. 8

shows the occlusal view of the lower arch after treatment, with the three incisors properly placed between the lower canines.

We remember when this case was first called to our attention, or first reported, that Hawley was more or less criticized for his treatment, and his judgment in the case was more or less a question. After the advent of dental engineering, the original set of models was sent to Rudolph L. Hanau for a dental survey. As the result of the dental survey Hanau concluded that the only possible way of getting a satisfactory occlusion from an engineering standpoint was to sacrifice one of the lower incisors. From an engineering standpoint this was done theoretically and the upper and lower arch reconstructed according to the plans of dental engineering with the lower incisor missing, and it will be seen that the shape of the lower arch and upper arch as sketched by Hanau from an engineering standpoint is practically the same as the result obtained by

Fig. 7.

Fig. 8.

Fig. 9.

Hawley in practical treatment. By examining Fig. 6 and Fig. 9 it will be seen that the position of the lower incisor as regards the upper central is exactly the same in the finished result as it is in the diagram. Dental engineering, then, proves that from the standpoint of mastication and efficiency the treatment as outlined and followed by Hawley was correct.

Etiologic factors responsible for the inharmonious size of the upper and lower teeth are something which will have to be considered later, but nevertheless it is a fact which does exist, and because of its existence we have deemed it advisable that the case be reported at this time.

TEACHING OF ORTHODONTICS FROM THE STANDPOINT OF THE STUDENT*

By William C. Fisher, D.D.S., New York City

When the chairman of the committee in charge of the program for this meeting asked me to present a paper, giving me the above title, I refused, stating that I considered the subject could be treated only by someone who possessed a qualification that I, as a student, did not possess; namely, a diploma from one of the known private schools. This deficiency, he very promptly informed me, did not disqualify. He thus dismissed my other exemption claims as fast as I could present them, and so I at last found myself a conscript. Indeed, if our government has any great difficulty in handling the exemption excuses of its conscripts, I can heartily recommend to it the services of the chairman of your Board of Censors.

Of a volunteer we demand *duty* plus *valor,* while of the conscript we demand *duty* only. So be kind enough to bear this in mind.

That there is something radically wrong with the present facilities, if not methods of teaching orthodontics today, nearly every student of this specialty is quite willing to admit.

I do not possess, therefore, I can not offer a solution of the entire problem, but I hope I may be able to stimulate here a discussion that will assist in outlining a workable plan that will ultimately solve this very important matter.

Orthodontia has been recognized as a specialty now for a good number of years—ten, perhaps twenty, years. That today the young graduate either knows little more, or else is little more interested in it than the graduates of ten or fifteen years ago, and that during that period, it has been necessary for him to attend private schools, for special instruction, is proof sufficient that there is something wrong with the present teaching of orthodontics.

And the further fact, that many so-called specialists, graduates of these private schools, often have as their only qualifications, an additional amount of knowledge of the methods necessary to this special work; but without that broad view of the general practitioner, is additional evidence of a fault somewhere in both the orthodontic and dental curriculums.

Success in orthodontia means successful correction of malocclusions, which in itself demands a full understanding of normal or ideal occlusion, together with much other knowledge.

Why are not general practitioners impressed with this important knowledge as are the orthodontists from private schools?

With a clear knowledge of occlusion and the importance of the preservation of the mesio-distal diameter of the teeth, especially of the deciduous molars, how many, many cases of malocclusion, could be prevented and later orthodontic interference be practically unnecessary.

*Read before the Seventeenth Annual Meeting of the American Society of Orthodontists, Excelsior Springs, Mo., Sept. 7, 1917.

Plea is often made that a busy general practitioner can not spare the time needed for orthodontic work. This is a wrong idea and should not be considered a just excuse any more than you would excuse a general practitioner for the same reasons, from performing any other character of mechanical construction. And many of us lose sight of the fact, that in small communities, the general practitioner is compelled to care for every character of dental work. His responsibilities in regard to orthodontia are just the same as to exodontia, minor oral surgery, prosthodontia, etc. Have we trained him to properly meet that responsibility? If not, wherein have we failed?

Just as the privately owned and controlled dental schools are almost a thing of the past, and our students may now receive instruction in dental departments of well regulated and high standard universities, so must the privately owned and controlled orthodontic schools, surely give way to well standardized postgraduate schools, under the control and supervision of our leading universities throughout the country.

Further: If these postgraduate courses are held, as they naturally would be under any such plan, in or near our large cities, and were made to cover two years of six months each instead of two months, and the hours of instruction so arranged, that they would not compel a man to devote more than four half days per week, more men could then avail themselves of such instruction and still conduct their practices. Another very great advantage would be (which is absolutely impossible in the present eight week private school courses) that a student could see the progress of the methods in practical treatment of clinical cases, and often bring these cases in a two year course to a somewhat satisfactory conclusion.

Still another advantage to be obtained by the establishment of postgraduate schools of orthodontia, and their proper standardization, would be, *ipso facto,* the standardization of the term "Orthodontic Specialist;" which term now any dentist may appropriate at will.

Not that I would for one minute be understood that I would not allow a general practitioner to practice the specialty; on the contrary, I think more general practitioners should be encouraged to take up the practice of orthodontia, along with their other work. That is what good postgraduate courses should accomplish. If he so wishes, and finds himself well qualified to do the work successfully, and particularly loves it, you may find him dropping his general practice and devoting his whole time to orthodontia. That is, if he is in a community that can support him in the practice of a specialty.

We find among general practitioners many who apparently have no desire to inform themselves about orthodontia. Would this condition exist *now* if the teaching of orthodontics in our dental schools had received its proper direction, during the past ten or fifteen years? I most emphatically do not think so.

Therefore, if the course in orthodontia in our dental schools be made of sufficient importance, we shall in the future find the graduates more interested in this special work and more capable of practicing the same and more desirous of increasing their knowledge by attendance on the postgraduate schools. And the postgraduate schools, conducted on liberal and large lines, will serve the double purpose of correcting the aforementioned apathy of the general practitioner and

furnish the opportunity of the interested, improving and perfecting their natural desire for specialized work. And further, there will result, what I believe, is the greatest of all good: That is by the interest in orthodontia that will be stimulated, and the high degree of mechanical ability, that will be developed; there will obtain a higher idealism and ability throughout the entire professional field. Remember that the profession will advance only in proportion with the advancement of its educational institutions.

We are extremely fortunate in having today in every large city one or more men of recognized ability in the specialty of orthodontia, who could, and I am sure would, serve on the teaching staff of such postgraduate schools. In particular cases they might well be organized, before affiliation with some university, but I want to emphasize the fact that only with that end in view are we justified at the present date in organizing what might be understood as quasiprivate institutions.

It would, of course, be better, could the original organization be made under the direction and control of a university with a dental department; thereby availing ourselves of the aid of collateral teachers and research workers, and also draw from their unusual abundant clinical facilities.

Another much desired condition, and this can apply to both the teaching of orthodontics in the regular courses, as well as the postgraduate courses, is a standardization of this subject, for every section of the country, so that, just as good specialists can be developed in the West as the South, and in the South, as in the East.

Like all great advances in scientific and educational work, mistakes will be made; severe adverse criticism will be heard; but these should not discourage, but rather stimulate, a greater effort to bring about an almost satisfactory, if not ideal, curriculum.

DISCUSSION

Dr. Martin Dewey, Chicago.—Mr. President and Members of the American Society of Orthodontists: The question of teaching orthodontics from the standpoint of a dental student requires a great deal of consideration, and it is something that may be approached from a great many angles. As the essayist took up the consideration of teaching orthodontics in the dental schools, we have a condition existing there which some of you are aware of, and in calling attention to this condition it refutes to a certain extent the argument made by the essayist regarding the establishment of postgraduate schools in universities. In the first place, the majority of large universities have no orthodontic department in their dental schools. An institution that does not recognize orthodontia in the ordinary dental curriculum of sufficient importance to have a professor of orthodontics is certainly not an institution to have charge of postgraduate instruction. That is one of the first difficulties we have to contend with. We have the condition of orthodontics being taught in some of the dental schools by the department of prosthesis. They have no separate orthodontic department. Then again we find undergraduate students are handicapped because correlated subjects are not properly taught. In the chair of dental anatomy should be taught occlusion of the teeth. That is done in very few schools. The chair of histology should teach the relation of dental tissues in regard to tooth movement. That is not done. In the chair of anatomy and physiology should be taught such things as are related to anatomic conditions found in malocclusion. That is not done. In other words, the student who leaves a dental college has to receive instruction in a great many things before he is qualified to receive proper orthodontic instruction. That is one of the first things we have to consider from the standpoint of teaching orthodontics. Now, we realize that orthodontics as taught the average dental student is not sufficient to qualify him to correct malocclusions, but is the dental student to be pitied as such any more than the medical student who leaves a

medical college without being qualified to practice surgery before taking a postgraduate course in a hospital, or serving an apprenticeship with a surgeon? Is the medical graduate qualified to make bacteriologic diagnosis in a pathologic laboratory before taking a special course in pathology and bacteriology? In other words, is the instruction received in orthodontics any more deficient than the instruction received in a great many branches in medicine? Can you expect a dental college to make a finished orthodontist out of every dental graduate? You certainly can not. You can not expect medical colleges to turn out finished pathologists and finished specialists qualified to practice the specialties of diseases of the eye, nose, and throat.

I have already called attention to the fact that there seems to be in the minds of some people an idea that the solution of every educational problem is to affiliate orthodontics with some large university. We hear men talk about the superiority of dental schools connected with universities. If you are interested in this subject, examine the reports of state boards and you will find the largest percentage of failures comes from the dental departments of universities. That is proved by reference to the reports of the National Association of Dental Examiners. The privately owned institutions, which are always looked upon as being insufficient, have a higher percentage of graduates pass the state boards all over the country than do the universities. That can be proved by referring to the reports of state boards. It is a fact that the graduates of certain universities have fallen down in their examinations before state boards. I have been told, that one institution contemplates resigning from the National Association of Dental Faculties because its university dental students have 50 per cent of failures. Are we willing to have orthodontics taught in such schools when students can be better prepared by taking private postgraduate courses? I do not think we are.

I have had some experience, as you know, in regard to privately owned dental schools; I have had experience with the medical and dental departments of universities and experience in postgraduate dental schools. I have been approached at various times to establish a department of orthodontia in two large universities. At one time I almost perfected plans to that end, but finally we got to the point of perfecting the proposition whether the university wanted to assume absolute control, which you may say is all right, but what assurance did I have that they knew how to run a postgraduate school? In other words, they would assume everything, and I was to work on a certain definite salary and not say what should be taught. That I refused to do. We do not claim that the type of postgraduate dental schools is perfect. Nothing is perfect, but we do believe a better postgraduate school can be conducted under the control of one man, who has devoted time and thought in giving the course, than can be given by the dean of a dental school who has absolutely no knowledge of postgraduate instruction in orthodontics.

Now, the question of a six months' course or a two years' course has been mentioned by the essayist. If you will stop and consider dental colleges and the discussions they have had with regard to a three and four years' course, you will find they have had great trouble in raising the curriculum. Now you want to insist on dental students taking four years of dental college instruction, and two years of postgraduate instruction in orthodontia, so that by the time a man gets through with his professional course he is ready for the old folks' home. You can not expect a man to spend two years more after he has gone through his dental course to complete his postgraduate course. How many of you will do it? Those of you who have criticized short courses have taken short courses, and some of you say that now we should make the courses longer. To be honest with yourselves, how many of you could leave your practices for two years to take a postgraduate course? This thing must be practical, as well as efficient, and I do not believe it is practical at the present time to give a postgraduate course of two years because you would be limiting it to a certain few. The man who can leave his practice and undertake a two years' postgraduate course would be the man who had an unlimited amount of money, and he would acquire the habit of going to school. The best student is the fellow who has to put himself through school, who sends himself to school; and the fellow who could spend two years in taking an orthodontic course would be the fellow who was sent to school.

The need of orthodontic work today is imperative. There are a great many malocclusions to be treated, and you can render people a greater service by arranging courses that are practical, that is, of sufficient length of time that a man can leave his practice and take these courses, than you will by carrying out the Utopian idea of having a two or one year's course. You must remember that this thing must be put on a practical basis.

The statement has been made that a man who goes out of a dental college and specializes immediately is not as efficient as the one who develops more mature judgment. My experience has been that the men just graduated from college make better orthodontists than those who have been out several years.

The standard of orthodontic instruction is an important factor. As I said this morning, and the committee on education will bear me out, I was instrumental in asking for the appointment of such a committee. We realize that orthodontic instruction must be standardized. We realized at that time there would be in the course of a few years a number of postgraduate schools devoted to the teaching of orthodontics, especially if one school seemed to be successful. The key to success is imitation. If any school succeeds in getting a number of students, and seems to be successful, somebody will try the same thing. The American Medical Association has worked for the standardization of medical colleges for years; and the American Society of Orthodontists should control postgraduate orthodontic schools, and it should go further and have something to say in regard to what course an orthodontist should be taught in dental schools, but we should try to make this thing practical, and not work upon the proposition that because two years' course seems to be Utopian, it is the only thing that can be given.

The question has been brought up as to what constitutes an orthodontic specialty. That probably will never be satisfactorily answered. Some have advocated a special examination by state boards for those men who are going to be specialists in orthodontics, but the average state board does not know much about orthodontics or the man who is going to be a specialist in orthodontics. The question has been raised that the man who specializes in orthodontics may not be able to pass a general examination of the dental board in other subjects. There is some room for both sides of the argument, but I think it would be much better to require a man who specializes in orthodontics to pass an examination in the entire dental field than it would be to license him on his ability to practice orthodontics. In the medical profession, if a man wants to practice surgery, he has to stand an examination on medical subjects. The dental profession has succeeded in certain states in getting what is called reciprocity, that is, if you register in one state you can register in another, if you do the practical work. Reciprocity from the standpoint of the orthodontist is an absolute joke because he has to go in and do certain things which he has not done for years—make gold crowns and plates, etc. In other words, he is examined in subjects he does not intend to practice. The state board says that we do not license you to practice orthodontics; we have licensed you as a dentist, and (if we give a special examination) you may then turn around and do general dentistry. From a legal standpoint, he who poses as an orthodontist can be held to greater account than one who does not pose as a specialist. The man who poses as a surgeon expects to obtain a better result from an operation than a general practitioner. The man who poses as a rhinologist must achieve better results than a general practitioner of medicine. The specialist is expected to get results beyond the average, but I am sorry to say that a whole lot of our results are not beyond the average, so that question will probably be one which will not be settled for some time to come.

The essayist also mentioned the fact that postgraduate instruction in orthodontics would be valuable to general practitioners of dentistry. That unquestionably is true, but if you go back to the old proposition, no matter how valuable such a course is to the general practitioner, the thing must be given in such a manner that he can take it, or it will be absolutely impractical.

The question of taking postgraduate instruction in conjunction with a general practice, as the essayist has outlined, is not satisfactory. In the first place, because there is an old saying that you can not do two things at once and do either one well. You can not conduct a general practice and study orthodontics at the same time satisfactorily.

The essayist has suggested that we give a course extending over a considerable period of time, devoting say four half days a week, or something like that, to the study of orthodontics, which will enable students to devote time to their general practices and at the same time take the course. I believe that we can accomplish more by intensive teaching in a short time than we can by stringing the instruction over a long period with other things to interrupt it.

He calls attention to the fact that in every large city the orthodontic specialist of recognized ability would serve on the teaching staffs of postgraduate schools. That has been tried by the Forsyth Infirmary. They have selected the men who should give instruction, but I know the majority of men who have been asked have refused. The man who

has a busy practice in orthodontia, if he is wise, will not fall in line with such a plan of teaching orthodontics. Men with large orthodontic practices will not devote a lot of time to postgraduate work. You have got to put this thing back on a practical basis. Men are not willing to make a definite sacrifice to teach in a postgraduate school. That is true in any line of teaching, and because a man is a successful practitioner of orthodontia or of any branch of dentistry or of medicine, is no sign that he is a good teacher. The worst failures in medical and dental colleges have been among the men who have been selected as teachers because of their large and successful practices. They have almost invariably failed as teachers. Teaching orthodontia or any branch of dentistry requires a certain amount of tact, a certain amount of preliminary training in normal schools, which the average orthodontist has not had. There is a large field for discussion which the essayist has opened up, and it will have to receive considerable attention. But a lot of the things he suggests are impractical, and they have been thought of a great many years before he suggested them.

Dr. W. J. Brady, Kansas City, Mo.—I feel that much more might be said on this subject, although Dr. Dewey has expressed my sentiments in the matter very thoroughly as I feel them. As many of you know, I have had some experience in teaching orthodontics, having put in twenty years on it under all sorts of circumstances in privately owned schools, in the large universities, and in privately conducted postgraduate schools, so, I believe, I may speak with some authority on the subject. While I am a graduate of a state university of which I am proud, and which I have later been honored by, being chosen as a teacher, and I regard this institution very highly, yet I know that with all the great resources of a state behind it, it fails to be competent to teach orthodontics as we would have it taught for specializing in the work. I know because I have tried it myself and because others have tried it. I did not have any success with it and they have not done much better. The reason, however, is not because the great university was supported by the state, but it is found in the fact that the average dental student does not possess the maturity to study orthodontics. Orthodontics is peculiarly postgraduate work, and it is only the men who have had opportunity to think, who have been compelled to think over the great many subjects, who are brought up in the postgraduate study of orthodontics, that have the real depth to undertake the work and to succeed with it. Now, those who have studied orthodontia in the private schools, the semiprivately owned schools, have done this thinking. They have done it whether they wanted to or not, and when they come to the privately owned school they are ready to take up intensive study of what must be given. For instance, a course of lectures can be given in six or eight weeks without any trouble, or without any particular trouble on the part of the men getting it. If they study it in this way after they have had the time to mature some of the problems, they actually get more and carry away more than if they have that same thing strung out for a considerable period of time, say a year or two years. Teachers in some schools do their best and have good opportunities to do their work, but students do not get it. Why? Why does not the three-year-old child, or the six-year-old child get trigonometry or Latin? Why is the child given the first reader? Because it is suited to him. He can only assimilate material of that kind. The dental student can only assimilate certain amounts of material, and therefore does not get orthodontics for that reason. Orthodontics taught in a regular course will not be a success for a long time. I wish it could be done tomorrow, but it won't be for a long time to come, and until that time comes certain men will have to get their instruction from men like Dr. Dewey, who has an organized school and teaches orthodontics. The only place where a knowledge of orthodontics can be had is in schools of that sort. Until we reach a higher educational plane, it will be the only place to get instruction of this kind for many years, not but that it would be desirable to have it elsewhere. Until the requirements are different, it can not be successfully carried out.

I am glad to have heard Dr. Dewey bear down on the practical side because practical things are what count with practical men, and men that have been in practice for a long time must be practical or they will go back to the milk wagon, the plow, or to the insurance agency where they are better suited.

I want to compliment the essayist because he has made an effort to bring about some things that he evidently feels deeply, and among them he feels that our present methods of orthodontic instruction are inadequate. The remedy does not lie in the planning out of the course to be given in a great university. I might say, that the big university is the hardest place to get anything done of any place on the face of the earth.

Give me the privately owned school when it comes to getting something. I have been there and I know. I know it is the experience of every man who has ever taught in any big university, that universities do not have money to carry on the various departments that they should have. Big universities are generally hard up, and the bigger the university the harder up it is from the standpoint of money, and so with that thought I will close.

Dr. C. A. Hawley, Washington, D. C.—I think we have had this subject very nicely and very clearly presented this morning and yesterday afternoon, and after that has been said I wish to say that the general feeling of the society has been expressed by Dr. Robinson regarding the practice of orthodontia. It is a matter of opportunity as Dr. Robinson previously expressed it. We should have greater opportunity for studying orthodontics than we have today. To my mind, notwithstanding what Dr. Dewey and Dr. Brady have said, I feel in regard to the teaching of orthodontia that there should be some institution in the United States where a man can take a postgraduate course in any subject in dentistry, at any time, during the regular school session, where he can study special work in pathology, where he can study all the different branches of dentistry, and with it orthodontics. I do not believe success would be as great in a one man school as in a school where the instruction is given by different men, and in that school a course in orthodontia could be given. There should be men in charge of the institution, and students should have an opportunity to come in contact with a number of men, and it should be a school where a general practitioner can go at any time during the school session and get a certain amount of instruction. If he wants to take a six or eight weeks' course or a three months' course, he can take it; but there should be a definite course which is necessary, and my idea is that this course should be a year long to receive the recognition of the schools. I say a year long, because that time is necessary to get the clinical work and the practical experience one should have. Conditions are different today than they were ten years ago, and we know more today than we did ten years ago how instruction can be distributed. I think with some additions, the plan the essayist has outlined is one that will finally raise the standard of instruction in orthodontics higher, and will afford greater opportunity for the study of orthodontics under modern conditions.

Dr. D. W. Flint, Pittsburgh.—When a boy goes to a dental school he goes for a certain purpose—he goes to learn how to fill teeth and how to make plates, etc. In teaching I have found it is mighty hard to induce students to study something they do not want, and they do not realize the importance of what you tell them until the year is over, when it is too late.

I have been well pleased with the remarks of Dr. Dewey. He has discussed the subject both from a practical standpoint and from a large practical experience.

Dr. Ray D. Robinson, Los Angeles, Calif.—Dr. Dewey made one statement that I can not let go unchallenged, that is, when he said the reports of the state boards throughout the country show that private schools were giving better instruction than that given in the great universities. I want to challenge that statement. I know what the figures are; I have seen them. So far as the figures are concerned, he is right; but you know and I know that privately owned schools, whether small or large, are not giving the instruction that the great universities are giving.

Dr. Flint has just said that a young man goes to school for a certain purpose, and dental schools are organized for certain purposes. These big schools are organized to give instruction. A lot of these private schools are anxious to get their graduates passed the state board examinations, and their students are coached not to go out and practice dentistry efficiently, but they are coached to get by the state boards.

Dr. R. Ottolengui, New York City.—I ought not to take part in this discussion, but something was said that prompts me to do so.

I am glad to get in close touch with brother Brady. There are some university schools that are not beggars, but they have money. I have had opportunities at different times to become a teacher, but I have refused because being interested in and devoted to journalism I have felt I had a free hand in attacking them, if necessary, and pointing out their weaknesses. I have made it my business to examine schools and see what they are doing. I have been very peculiarly and deeply impressed with what I saw in the University of Minnesota which has caused me to change my views in certain matters. I have contended that dentistry is not a specialty of medicine, and that all the teaching a dentist needs can be taught to him in a dental school, but I have to back water a little

on that after visiting the University of Minnesota. I do not know where they get their money, but they have it, and as a result they have an enormous plant. Their pathologic building alone is larger than most dental schools, and as a result of it they can carry on research investigations and teaching at the same time. But the most impressive thing there to me was this: they have also a hospital which was primarily intended for the use of medical teaching, and through Hartzell and through the superintendents they found out there was some relation between oral disease and systemic disease. They finally gave the dental investigators three or four beds and now they have three whole wards, one for men, one for women, and one for children, all of whom are referred to the dental ward when they have diseases which may be explainable by dental trouble. Little by little dental offices have been established, so that they can operate in a dental way on some of these people. There is no doubt in my mind that if you can get the same kind of teachers as you have in the privately owned schools and add to them the advantages of a big university equipment, you will certainly be able to turn out a better product.

I think very largely the difference in the results shown in these university schools of their graduates passing or not passing the state boards is based on the fact that the university schools have large classes. For instance, a school sends six graduates from Illinois, and three of them fail, it is fifty per cent failure. On the other hand, if six of them pass the state board examination it is a hundred per cent success. These kinds of statistics are not comparable to a school that sends 150 for examination. The more men you have to teach, the more unteachable men you will have to deal with. It seems to me, the ideal thing that must come some day and will come, and it is in the minds of the Board of Regents of New York, is for the big universities in New York to teach every special branch in a building specially devoted to the teaching of that branch, but with the correlated diseases, and with all the equipment that a large university has without any stinginess in the matter of money.

Dr. Dewey is a little prejudiced in favor of the privately owned school. He knows what he is doing in his school, but he can look back to the days of the proprietary school in dentistry when the proprietors were out more for money than they were for making a fine product. As the doctor makes a lot of money in that school, a lot of other schools will spring up for the money there is in it and not for the product they expect to turn out. Just so long as he has a small school and has intensive study, it will be successful, but that does not prove that the privately owned school is correct.

Dr. W. C. Fisher.—There is very little to add to what I have already said in my paper. Dr. Dewey misunderstood me in some respects or I did not make the subject clear. I am not after the dental school to turn out a finished orthodontist any more than the medical school is expected to turn out a finished surgeon. It was not my idea to have the teaching of orthodontics incorporated in the dental curriculums; but graduates in dentistry should know more about orthodontics than they do today, then they will go to a postgraduate school.

Personally, I am not convinced that the dental departments of our large universities are turning out poorer material than private schools.

I referred to the two years' course only because of the fact that I want to see men take cases from the beginning to the end or until they see the finished prdouct. I think we will all admit that in the most difficult cases, it takes two years for the man to see the results of a certain technic.

Again, we all lose sight of the poor chap in a small town of 5000 or 20,000 inhabitants. I was thinking of big cities where we can hold these postgraduate courses. We have a postgraduate school of medicine in New York, where a man can study one week, two weeks, or study only two days. He pays for it and leaves. I would like to see a school established where a man can stay long enough, if he has a certain definite curriculum, to receive a diploma from that school; but still there may be many of you, like myself, who would like to go to a highly organized postgraduate school and spend two or three weeks and brush up on some particular feature of our work. It does not mean that we have to go through the entire course. That entire course is for the man who has not been practicing orthodontics.

Again, Dr. Dewey speaks about the man who spends four years in a dental school, and on top of that takes a high school course, and says that such a man will not take a course of two years more in order to practice a specialty. Well, I think even the med-

ical colleges will have to cut down their preliminary education to get men out into the world sooner to earn a livelihood.

He says many of the students in colleges in working their way through college have got to practice. The man who wants to acquire knowledge so badly that he works himself through college will also work himself through a postgraduate course. If you can get good, conscientious teachers, and this organization bears testimony to that fact, for an eight weeks' course in a private school, it seems to me you can get good teachers for a postgraduate course under university supervision.

FREE ATTACHMENTS

By Carl O. Engstrom, D.D.S., Sacramento, Calif.

MECHANICAL ingenuity for many years past has invented a very great number of appliances for the correction of malocclusion of the teeth, and the claims made have been such as to create the idea that orthodontia is mainly the mechanics of an appliance. The mechanics of the appliance has been made quite distinct, for little attention has been given the mechanics of living tissue, although it is the most important. This has resulted in a misconception of orthodontia. It may be noted that of the interrelated subdivisions, the study of mechanics is but a part of the whole study of physiology. A most interesting part of these appliances has been the attachment (such as the connection of a band on a tooth to an arch wire), a part which has occupied a most prominent place in the consideration of appliances. It has seemed to be the aim to present an appliance with an attachment whereby every direction of movement of a tooth may be accomplished in the correction of malocclusion by the use of the one attachment. This, it seems, has led, no doubt inadvertently, to considerable disregard for the living tissues to which it was to be applied. It is not to be inferred that the attachment is the most important part of an orthodontic appliance nor that it stands alone in application to the principle to be mentioned; but that all parts are equally important and also enter into other physiologic factors in orthodontic treatment other than that stated herein. Neither should the thought be entertained that treatment should be made subordinate or in accord to the workings of an appliance, but rather that knowledge of living tissue should direct the use of an appliance which is merely an instrument in treatment.

To elucidate the subject, attachments are divided into two classes, free and fixed. While attachments have been considered mainly from the standpoint of moving an object through inert matter, the word "free" as used has little such mechanical significance, but rather refers to the phase of physiology to be presented. In this latter respect an attachment has an effect on the functions of tissues whether the tooth is being moved or not. Free attachment refers to any artificial means used to exert force to change or maintain the position of a tooth, which means does not prevent the movement of a tooth in the performance of its function, other than is necessary to the establishment or maintenance of its proper position. Free attachment is used in contradistinction to an attachment

wherein the tooth is interfered with in its function other than that which is necessary to its correction. This latter may be termed "fixed attachment." A ligature, properly applied, linking a tooth to an arch wire, and a wire in juxtaposition to a tooth are illustrations of free attachments; and a wire soldered to bands on two teeth illustrates a fixed attachment. Both free and fixed attachments have been extensively used. The last mentioned illustration can not be other than a fixed attachment, but a free attachment may easily become fixed when so adapted. The free attachment is one of mechanical simplicity, but it is often a very complex study to be considered as requiring the utmost knowledge, judgment and skill on the part of the operator.

Physiology should be the predominating factor in the consideration of an attachment; for fundamentally orthodontia is a study of physiology, particularly the physiology of all parts instrumental in mastication. Orthodontic treatment has for its object the improvement of function, the establishment of greater efficiency through structural changes. By structure, the orthodontist recognizes the physiology of the several parts. The activities of life, movement, and force in the one cell excite similar action in another cell. Cells live by functionating which when lost presages death. Health and efficiency of tissues are dependent on this interchange of forces. Force exerted on the crown of a tooth as in mastication excites force on the root of the tooth. This transmission of forces represents a function of the tooth. Of itself the tooth does not move, but is moved, and acts as a medium in the contraaction of forces. The form of the crown of the tooth and its many angles of resistance in the process of mastication are all reflected in the arrangement and movement of the fibers of the peridental membrane. The fibers of the peridental membrane allow for movement of the tooth in its bony alveolus. Function of the membrane is depicted in the arrangement of the fibers. This movement is the normal exercise of the membrane. If this is not to be considered in the function, then why this arrangement? Note the structure and it will be seen that this arrangement allows for movement of the tooth in many directions. By way of explanation, sixteen directions of movement of the tooth may be cited. The tooth may move bodily, mesially, distally, lingually, facially, in elevation, in depression, and in rotation on its long axis to the right and to the left. Considering the apex of the tooth as the axis, the tooth may move mesially, distally, lingually and facially; and with the crown as the axis the tooth may move in all of these directions. These directions, herein considered in the application of an attachment, also denote malpositions of teeth. As a rule combinations of these sixteen separate and distinct movements occur in mastication. It may readily be seen that a rigid or fixed attachment interfering with these movements would affect the health and efficiency of this membrane. The exercise of this membrane in the promotion of stimuli to the surrounding bone is important. The dependency of one function on another function is shown in the form of one structure and another. The function of this membrane is reflected in the surrounding bone and the character of the bone is reflected in the character of the attached muscle. Thus from a study of one part, the efficiency of other parts may be determined.

In the case of heavy mastication, all structures involved in the action

present formations in keeping with the great forces excited. There is a balance in the relationship of function and structure. Where all function is removed, as in the case of the removal of a tooth, those parts that possess no other function than that in conjunction with the tooth disappear and the structure of the remaining process reflects the change in use. If a tooth is held rigid as by a soldered attachment, in other words a fixed attachment, the surrounding structures will be altered just to the extent of the loss of function. As the function of one part affects the function of another, likewise, it is so of structure. The change in structure due to change in function may be noted in the case of a tooth that has been held stationary (it being understood that this state is not exactly obtainable in orthodontic practice) for some time and found loose upon removal of the appliance. Add to this loss of bony support that which occurs in the movement of a tooth by an orthodontic appliance, and is it not to be expected that the root of the tooth may be absorbed along with the surrounding bone? The proper function of cells is interfered with. The tooth by loss of function and being moved under the influence of a rigid attachment may be likened to a foreign body. Movement for correction under these conditions will result in more or less katabolic changes in the tissues. Often a tooth is presented wherein only one or two directions of force are required to place it in its proper position. Then why interfere with its fourteen functional movements? Such interference appears unscientific. Deciduous teeth may be moved by the use of free attachments with very little appreciable looseness.

While it is necessary to interfere with the normal movement of the tooth in the direction opposite to the direction of applied force, the aim should be to improve function with as little interference with the normal action of the parts as possible. The forces used in correction are less useful as the loss of function becomes responsible for a like condition of structure. In the correction of malposed teeth, they should be moved in the particular direction or directions necessary in the correction without needless interference with the functions of the tooth and of other tissues. This involves the application of the free attachment.

PRESIDENT'S ADDRESS BEFORE THE AMERICAN SOCIETY OF ORTHODONTISTS, SEPTEMBER 5, 1917

By M. N. Federspiel, B.Sc., D.D.S., M.D., Milwaukee, Wis.

Professor of Oral Surgery in Marquette University.

PERMIT me at this time to express to you, the members of the American Society of Orthodontists, my deep appreciation of the high honor that you have conferred upon me in selecting me to preside over your deliberations. I would be happy indeed, but for the sense of unworthiness on my part to fill so high a position. I shall always esteem the presidency of our society, composed, as it is, of the leaders of orthodontic science and art in this and other countries, one of the highest honors conferred on me.

Carlyle has said: "The profession of the human healer is radically a sacred one, and connected with the higher priesthood; or rather, is itself the outcome and acme of all priesthoods, and divinest conquest of the human intellect here below—as will appear one day."

It is self-evident that the wisdom possessed of the art in treating human ailments, is the measure of the refinement and civilization to which the people have attained. Science in its broadest sense is synonymous with learning and knowledge. In early times when the knowledge of nature was small, it was not necessary to divide science into parts, and men of science did not attempt to specialize.

As the scope of knowledge and wisdom increased it was impossible for any one man to be familiar with all scientific subjects, so that there is a tendency to have a division and classification for a better understanding of certain subjects.

The accumulated experience of one department of science, and the special methods which have been developed to such a high standard to deal with its problems, become necessary in another department.

Geology uses the methods and data of physics, chemistry, and biology; Sociology needs biology, yet some group it with economics; the practice of medicine is nothing more than applied biology, which uses the methods and data of chemistry.

The high development of the different channels in the different sciences will ultimately bring about a better understanding that after all science is in reality one; yet we may approach it along various paths; we may view it now from one side and now from another.

The history of the healing art is as old as the history of the human race. Unfortunately the past has not preserved the name or any monument of the benefactor who first ventured upon the attempt to relieve the maladies of his fellow beings. To know this would be equivalent to knowing the origin of civilization.

What is regarded as learning, erudition, or wisdom, is a treasure which others have won and possessed before us. It is the promise of intelligence, to investigate causes and origin, to become free from the narrow limits between the cradle and the grave. We become broader, wiser, purer, and better for having learned of what has been. It strengthens our faith and ambition in regard to the future; we become liberalized, refined, and ennobled. By such eating of the tree of knowledge, the eyes become open, and the man is as a god. He makes the divinest conquest of the human intellect.

Orthodontics must be considered as a specialty, and to understand it one must be grounded in the fundamentals of the science. Unless one understands and appreciates the principles concerned in the handling of tissues, the causes and result of inflammation, the principles of mechanical engineering, the pathology of conditions that bring about malposition of the teeth and dento-facial deformities, prognosis as well as diagnosis and many, many other important factors, he can not have a complete understanding and properly manage orthodontic problems of everyday occurrence.

Orthodontics is far too serious a matter to be lightly undertaken by those who are not thoroughly trained in the fundamental principles underlying its proper performance. Yet it is of common occurrence among dentists to attempt the handling of orthodontic cases, who through flattering advertisements, by trade houses and mechanical laboratories, are led to believe that the correction of malocclusion and dento-facial deformities are free from perplexities upon the purchasing of certain appliances that are constructed, patented, and indorsed by some famous orthodontic wizard. I do not know of anything that is more vicious than this so-called patented cure-all appliance to undermine the progress of scientific orthodontics and degenerate it with a trade or slight-of-hand performance.

There is no such thing as orthodontics made easy; there is no trick about it that can be learned in a few weeks' course by making beautiful models and free-hand soldering, by watching the manual dexterity of some clever operator and admiring models and photographs before and after treatment.

It is so easy for young dentists to be led by such false gods into believing that a specialist can be manufactured by adopting a system and appliance. It looks so easy, and it seems to simple.

Right here I am reminded of the time when I was young and just out of a dental school. I had completed a few weeks' course in orthodontics, returning home with a diploma as a distinction of high training. I had the good fortune to meet a beloved teacher and friend, a man of wide experience and excellent judgment and possessed with a vision of broadness in its scope, not only being highly trained in dentistry, he was a wonderful physician and surgeon, the late Dr. B. G. Maercklein.

When I informed him of my intention to specialize in orthodontics he remarked: "My boy, remember that any ordinary orthodontist can move teeth; it takes years of study, experience, and observation to hold the teeth in their new position." It is well therefore, for a dentist before he poses as an orthodontist to weigh well the responsibilities that are involved. The inexperienced operator, owing to lack of proper training and insufficient experience is usually at fault in working out a clear diagnosis and prognosis. He attempts to do something that he is not competent to do. He places himself in a false position before his profession and the community.

Such a man reminds me of the young medical graduate, who through procrastination and having a rich father to rely upon, was not making much of a success as a medical practitioner; so he decided that a trip to Europe would fit him as a specialist. When he arrived at the Allgemeines Kranken-Haus, and was told that in order to be a specialist he had to knuckle down to hard, strenuous work, he was satisfied to let the other fellow use the microscope, while he enjoyed a student's visit at the beer table. After six weeks' sight-seeing in Vienna, Berlin, and London, he returned to his home town and introduced himself to the profession as a specialist with the following words: "I have just returned from over the seas, send your cases straight to me, I am a specialist, yes, by gee, and I belong to the state society."

I have observed, in my time, that quite a number of practicing dentists,

who have always been a flat failure in the practice of their profession, spend a few weeks in some postgraduate school and then pose as a specialist in some branch of dentistry. This sometimes makes me wonder that if the specialties are to draw their recruits from the failures in the mother profession, then we can not hope to look forward to higher achievements in the various specialties. The advancement in orthodontics depends entirely on the type of men that are enrolled in this field; therefore, it is necessary that the dental profession encourage that every dentist before entering a dental school must be possessed with a broad and liberal education so that he may understand and comprehend the interrelated sciences.

Travel as I may through this entire country visiting dental offices, I am more than surprised to find that the material comfort of the patient is very much in evidence while the scientific equipment is hopelessly in the minority. The most powerful weapon today in the hands of the profession against quackery of all sorts is a well equipped laboratory attached to the office of a dentist. The laboratory with a work bench, vulcanizer and casting machine must be enlarged to include a complete armamentarium to conduct proper investigations along bacteriologic and pathologic lines. While this may seem to add considerable more work, it makes the practice of dentistry of absorbing interest when one feels that he is approaching the study of a case equipped with modern methods. It is lack of accessories and inability to use them that makes so many men diagnostic misfits and careless in their treatment.

It is our duty, yours and mine, to see that dental education is limited to those institutions that can and do give proper opportunities to their faculties and students. We should see to it that public sentiment is aroused in support of this necessary advance. So long as the profession of dentistry, including its various specialties, tolerates our present day methods of dental education, and manufactures technicians instead of true scientists, quackery will predominate in its various forms.

The highly trained stomatologist does not have to yield to quack methods or does not become enthusiastic over the "cure-all" remedies that are so widely advertised in our trade journals and periodicals. Let me illustrate to you what happens to men who are not trained along scientific lines. Most of you will recall how so many physicians and dentists over this entire country became hysterical over the guarantee pyorrhea cure called emetine. Drug houses, anxious to reap a harvest while the reaping was good, sent out armies of drummers in the garb of the pseudoscientist to teach the poor dentist to fight the ameba buccalis and thus establish a pyorrhea cure. Trade dental journals were filled with advertisements of reports of cures; newspapers and weekly periodicals told of this wonderful miracle. Thousands of patients were given emetine injections by dentists and physicians, the whole country became emetine mad. This all happened long before research laboratories could tell of the merits or demerits of emetine.

Almost simultaneously with this emetine delusion another fad developed better known as the "tooth pulling rheumatic cure." Unfortunately many patients had teeth extracted that could have been saved through scientific

dentistry. The reason for the extraction of these teeth was that the dentist was led to believe that the interpretation of certain dark areas in a dental film was sufficient grounds to warrant immediate extraction, thereby removing the primary cause of the systemic condition. This brings me to the interpretation of dental x-ray. Strange as it may seem, the x-ray has been and is a much abused instrument. The roentgen ray was never intended to reveal the exact pathologic findings at root ends. The best that it can do is to aid us in our various tests to draw our conclusions. No man has a right to base his treatment on the reading of an x-ray picture without taking into consideration the various tissue changes that may take place in dental pathology. When men have a true understanding of the tissue changes that take place in acute and chronic inflammation and are familiar with the histopathology of morbid conditions involving root ends, then, and then only, can they realize that the dark areas involving root ends in the reading of a radiograph does not always mean a root abscess or a blind abscess; that the dark area may be nothing more than less density of bone, or an epithelial root tumor, or a root cyst, an innocent granuloma, a suppurative granuloma, an apical ostitis, ostitis fibrosis cystica, a rarefying apical ostitis, a root end necrosis, a root end cementoma, or a proliferative pericementitis. Unless a man has an understanding of these various pathologic manifestations he has no moral right to interpret x-ray films.

If dentists would have had a more liberal and broader education in the interrelated sciences, they would have then been in a position to point out to the advocates of this hysterical fad that it requires more than an x-ray film to make a differential diagnosis.

In our own specialty we have our fads. Our journals are filled with advertisements in which mechanical laboratories advertise their wonderful method of fitting appliances to models, of their orthodontic expert who is able to make a diagnosis and prognosis by the mere study of a crude model. I almost shudder when I think of the remarkable increase in the so-called "mail order orthodontic treatments" that is being carried on among dental laboratories. Then there is another fad that seems to have swept over this entire country, known as "the radical expansion of the supermaxillary bone in order to separate the palatin suture," thus giving more breathing space in the nasal channels for the patient who was supposed to be a mouth-breather. Rhinologists and dentists who had no understanding or training of the forces of occlusion became enthusiastic and laboratories were busy fitting jack-screws to models. Arches were widened regardless of whether the occlusion was normal or not. I know of one case where a so-called specialist went so far as to expand a normal arch for the purpose of trying to cure a case of otosclerosis.

It is ignorance, or lack of training, or to be spectacular, and a madness to extract American dollars, that has tempted young men to ignore the fundamental principles of modern therapy and surgery. Is it not high time that we clear the atmosphere of the things that are obnoxious to science, and devote more time in our literature and meeting places to studies that will develop the practitioner skillfully so that he may give his patients the benefit of all the accessories which are so important in the recognition and successful treatment of disease? There-

fore, I would recommend for your consideration that, if we are to develop along progressive ideas, we must encourage enthusiasm based on scientific investigation.

Some time ago our society had the pleasure of listening to a splendid paper which was read by Dr. Lourie, entitled: "Compromised treatments." It seems to me that when we review the literature in orthodontics during the first fifteen years, very little has been published upon mutilated cases and extreme malformations where it was impossible to obtain a complete restoration of the forces of occlusion. Strange as it may seem, the average orthodontist has not been doing his duty to encourage the treatment of this class of work. While it is fitting and proper to encourage the treating of malocclusion during the period of tooth eruption, we should, as specialists, be in a position to be ready at all times to diagnose, prognose, and treat these extremely complex cases, which have not had an opportunity to be benefited in childhood. We should endeavor to encourage the investigation and handling of these extreme malformations.

At the last meeting of our society held at Pittsburgh, Dr. F. C. Kemple, in his presidential address, called your attention to the need of standardizing our clinical records in the following words: "One of the weak points in the fabric of orthodontia today is the scarcity and incompleteness of our records of both treated and untreated cases. I am more than pleased to have on the program of this meeting a paper by one of our veteran members on the subject, 'The Records of an Orthodontist.' To my mind this is one of the most important subjects with which we have to deal, because of the fact that in the final analysis these records must form the very foundation of our knowledge of malocclusion."

Most of you will recall that splendid paper entitled: "The Records of an Orthodontist" read by Dr. B. E. Lischer, which was published in the March, 1917, issue of the *Dental Items of Interest.* Following the Doctor's address, the Forsyth Dental Infirmary requested the appointment of a committee to suggest a standard system of record cards, so that the enormous amount of material at the Infirmary might be standardized, classified, and made available for the profession. I sincerely hope that at this time the committee will be in a position to present, in concrete form, a report on this matter.

It is unfortunate that our society has failed to standardize our clinical records. If every member in this society would have carefully recorded his cases, during his orthodontic practice, we would then be in a better position to draw our conclusions in the diagnosing, prognosing, and treating of cases.

I wish to call your attention, at this time, to the need of revising our Constitution. At the last meeting a committee of three members was appointed to suggest corrections and revision of the Constitution and to report to the society at this meeting. I sincerely hope that the committee will make its report and that the matter will be given a free discussion on the floor.

While orthodontics has made remarkable progress and the literature is becoming voluminous, our terminology is being sadly neglected. If the American Society of Orthodontists is to be the representative society in orthodontics, then it should have enough pep and initiative in itself to go on building its own roads and bridges, to tell the world that it is on the map and that it is helping to write history in the pages of American dentistry. One of the most important matters

to be settled is a correct terminology. It is pathetic and pitiful to be associated among friends, who are supposed to understand the science of orthodontics, who can not write or talk intelligently on the pathology of oral deformities.

This, no doubt, is largely due to orthodontic provincialism. As long as we remain slumbering and unawakened and are willing to follow in the footprints of the egoist, we can not hope for scientific progress. Therefore, we should discourage within our membership the imitator who is willing to let well enough alone, who makes no advancement, but remains a parasite of the society. Right here I wish to quote the following from an editorial in the Journal on *The Imitator:* "The imitator is a vulture of human achievement. It is the dead hand that would paralyze initiative, stifle effort, and dry up the spring of hope and courage. It would perch in its somber garb over the cradle of new thoughts, new ideas, and great ambition. It would strangle in its icy grasp the great dreams of human progress, it would drape its banner of defeat over the forces of civilization, and would turn back in their course the stars of human grandeur." The future development of orthodontics, the standing we hold in the community where we practice rests entirely with us. I do not know of any way of uniting the society on a more solid foundation than by creating a spirit of enthusiasm in each and every member to strongly indorse the American Society of Orthodontists. This society may rightly be considered a clearing house, a means to an end, a postgraduate school, a representative society of progressive orthodontists, but there is much to be accomplished; like the battle of life, it means to struggle on, to blaze awav. to learn to exchange ideas, to be familiar with orthodontia as it is practiced in this and other countries, to learn to give our patients all that orthodontics offers, to help the weak, to encourage the strong; to do this and more we must sacrifice ourselves to the task of laboring among our fellow practitioners in order to raise orthodontics to the high standard of which it is deserving.

The American Society of Orthodontists should be democratic and charitable, its doors should be open to all men who are willing to conduct themselves along professional lines. Political and star chamber sessions should be discouraged; men elected as officers should realize that they owe a duty to the fellow member in guiding the future of the society, to engender fraternalism, to help the weak and to encourage the strong.

DISCUSSION

Dr. C. A. Hawley, Washington, D. C.—I have only had an opportunity to glance at the paper a few minutes before the meeting, so that it will be impossible for me to present an extended discussion.

With the main tenor of the paper I am in hearty accord. The ideals on education are well worthy of the writer of this address. His statement of the dangers to which the science of orthodontia is subjected from imitators and from men poorly prepared is not overestimated; but, it seems to me, as a protection in our profession, as in other professions, we have the honest, honorable and thorough work of the best men; and the protection of the people lies in the honest work of men in our society, as well as other othodontists throughout the United States. It seems unfortunate that we have no established school to prepare our men as we should for this work. It is unfortunate that Dr. Angle could not have continued his school and be enabled to carry out the high ideals in orthodontia which he established. We know that a man can not equip himself as an orthodontist in the true sense of the word after eight weeks or a few months of instruction. We should have a postgraduate school with a year's course and with a continu-

ous clinic, where cases can be observed from the beginning to the end. It is only in this way that we can have adequate preparation for the practice of orthodontia. Unfortunately that does not obtain at the present time. I think if this society could exert any influence in establishing such a course, it would be a good thing. I think we have a committee on education, which should be of some use, but I do not know how much work the committee has done.

Regarding another topic discussed in the address, namely, the revision of the constitution and by-laws, I am in hearty accord with what our President has said, and I think it would be well to appoint a committee in accordance with his recommendations to revise the constitution and by-laws and bring them up to date. There are some things in our constitution and by-laws that can be greatly improved, and I think it would be well to have a committee appointed at this meeting for that purpose.

I have been much pleased with the address.

Dr. B. W. Weinberger, New York City.—There is very little in the president's address with which I can disagree. There is one thing that I think ought to be brought up and considered, and that is the revision of the constitution and by-laws. A number of changes can be made which will benefit the society, if such a revision is undertaken.

With reference to the matter of general education of the orthodontist, this is a serious and important question. It is really a dream to think it can be realized at the present time under present conditions, but I believe if some action could be taken by this society designating what constitutes a specialist and who can be eligible in the true sense, as members of this society, it would be a great step forward in the science of orthodontia. There are a lot of small postgraduate courses that amount to absolutely nothing and I fear are doing a great deal of harm to the men who are trying to do sincere and honest work. I think that any action this society may take, if it is within its power to do so, would be a great help to these men in placing orthodontia on a definite scientific basis.

Dr. Martin Dewey, Chicago.—I have not very much to say in regard to the president's address because I agree with it, especially with regard to the revision of the constitution and by-laws.

As to the statement made with reference to postgraduate courses, I can not let it go unchallenged. Reference has been made to the inadequacy of present postgraduate instruction, one of the speakers saying that a postgraduate course of eight weeks is insufficient. If I remember correctly, some of the gentlemen present received their postgraduate instruction in such a school.

As regards the insufficiency of postgraduate work, Dr. Hawley made the statement that it is unfortunate the Angle school has been discontinued. We have all great respect for the Angle school, but some of us know that better courses are being given now than in the Angle school.

Another speaker (Dr. Weinberger) said that the present postgraduate courses of instruction do not amount to anything. That is an insult to a great many men who have taken these courses.

Several years ago, at the Toronto meeting of the society I was instrumental in getting a committee appointed to look after postgraduate instruction and to see the proper postgraduate course was given. This commitee did absolutely nothing, so do not criticize the postgraduate schools, but criticize your own committee. The postgraduate schools have been more anxious to have a standing or to have a rating than the society has rated them by concerted action.

Dr. Weinberger.—Referring to the postgraduate schools in my previous remarks, I had reference more particularly to the condition we have in the East and no doubt elsewhere. In New York there are a number of dental societies giving postgraduate courses and sending men out who later specialize. Those men have had inadequate instruction; the courses are too short and slipshod, while the training is insufficient. Some definite action should be taken at this meeting with regard to these men who are turned out as specialists from such schools after a short course of instruction. That is the type of school I was referring to.

Dr. Hugh G. Tanzey, Kansas City, Mo.—I would like to comment briefly in regard to the experience necessary to do orthodontia as referred to by Dr. Federspiel in his address. It is generally recognized that we should know all we possibly can and have all the experience that is possible before commencing to practice orthodontia, especially before we make a diagnosis and give the prognosis; nevertheless, the fact remains that we can not all have a great deal of experience before we begin. I took a four or five

weeks' postgraduate course, if you will pardon the personality, after I had experimented with orthodontia for over ten years. Then I experimented two years more before I began to limit my practice, and I must admit the greatest failures I have ever had have been since I have taken postgraduate work and been limiting my practice. I do not think there is a man in this room who can stand up and say after all his experience he has not had failures in his work. The point is this: if you want to get anywhere in orthodontia or in any science, you have to make a start, and I would say to the young man, who has made up his mind to be an orthodontist, dive into it. I do not care what postgraduate work he does, if he is painstaking, he will work his way out, and if he is conscientious and has ordinary horse sense, he can do his work as well as the men who have had more experience. We are all having failures if we would only admit it.

In regard to the postgraduate schools that have been mentioned by Dr. Hawley and by Dr. Weinberger, I agree heartily with Dr. Dewey when he says that there are better postgraduate courses being given today than the course given by Dr. Angle. I do not see why the course of instruction should not be better. The men we have at the head of these schools today are ambitious, industrious, and conscientious. They are thinkers and hard workers and possess the knowledge and practical experience to back up what they teach. This course will be found good enough if we will back the men up and assist them in carrying on this course.

I agree with Dr. Dewey that the men who have taken such a course as he has referred to can not help but feel a little insulted at the remarks that were made. I am not referring to the short courses in orthodontia. Most men have taken at least one course, some of them two, and they are working to improve themselves, and that is about as good as can be done under the present conditions.

Dr. Hawley.—I took a six weeks' postgraduate course myself, but it would have been better had I taken a longer one. It was the best to be obtained at that time. A six weeks' postgraduate course is of value, but a much longer course, where students can not only put appliances on cases, but observe cases that have been under treatment, studying their progress from the beginning to the end, is of much more value.

Dr. Dewey.—Dr. Hawley has referred to a continuous clinic. In our school we have had a continuous clinic since 1912 the year round.

Dr. Ottolengui, New York City.—Any legal practitioner of dentistry has a right under the law to practice orthodontia; and when he voluntarily takes a postgraduate course in order to learn more than he was taught in the original school, it is a matter for his own conscience to decide whether it is fair to the children of the community in which he lives for him to announce that he will make a special practice of orthodontia. I for one would dislike very much to see the society set up any special standard of what a man should accomplish in order to be recognized as a sufficiently educated specialist to become a member of this society. The society is intended to be a helpful means of developing the education of men who wish to be specialists. It seems to me that one mistake which has been made in regard to postgraduate schools in the past, and I think this is what the president meant, is that the schools have left the impression upon their students that if they graduate from that particular school they would then be competent to correct any form of malocclusion. Later on, these men learn by experience that this is not true.

Dr. Calvin S. Case, Chicago.—I did not expect to be called upon to take part in this discussion. In the first place I would like to compliment the writer of this address in regard to what he has said concerning orthodontia.

I am quite in accord with Dr. Hawley relative to the question of postgraduate schools or any school of orthodontia, as some of the gentlemen present are doubtless aware. Whenever they have appealed to me for advice as to what particular school they should attend, I have referred them to Dr. Angle's school, believing it to be the best school at that time. By attending this school, it would give them a good start; it would stimulate them to go out and do better work. It is a mistake to think that a school stamps a man. It is the man behind the gun after all. No matter what school he goes to, if he has the desire and ability and the ambition to excel in orthodontia, that is all there is to it regardless of where he received his first training. If you will pardon a personal allusion, if I were stamped according to the teaching I received in a five months' course in the school I was graduated from in dentistry,—which you all know is very inadequate, the status of my professional life would be poor indeed.

Dr. Ray D. Robinson, Los Angeles, Calif.—This question of education, it seems to

me, resolves itself into one of opportunity. Some of us had six weeks' postgraduate work and some eight weeks. There is not a man here who has taken six or eight weeks of postgraduate instruction, who would not have taken a year's course had he the opportunity to do so.

In criticizing postgraduate schools of today, I do not think my friend, Dr. Dewey, will tell you that his school is as good as it should be. It seems to me the American Society of Orthodontists ought to support some postgraduate school. Whether it is Dewey's school, or another organized by this society. It is certainly within the province of this body to get behind an educational movement. If Dewey's school has the start and this society wishes to get behind it and push it and make it what Dewey would like to see it, then let us do it. If, on the other hand, Dewey's school has not the standing or the start, then let us organize one. Let us get some place where young dentists, who want to study orthodontia can go and get all there is to be given in our specialty.

Dr. Burt Adell, Toledo, Ohio.—The essayist has given us inspiration and food for thought, and we ought to be thinking along this line. No man who has taken a six or eight weeks' course feels it was sufficient.

When Dr. Dewey says there is a continuous clinic at his school, I would like to ask him if that is an answer to Dr. Hawley's suggestion. If these clinics are continuous, are they accessible to the men who have taken the course. I understand Dr. Hawley's contention was that when a man takes the lectures he should have a chance to develop the technic and he can do that through watching these particular cases. I do not think there is any school which affords that opportunity. I think most of us would be willing to hold up both hands in favor of a longer course. I have felt the need of it in my practice since 1903. If I knew a boy or a man interested in orthodontia, I would try to send him to a school that gives a longer course. I would do it because he needs it.

Dr. E. G. Weeks, Saginaw, Mich.—I took Dr. Dewey's course and as far as a continuous clinic is possible, I believe that is what we had the advantage of. I saw cases in all stages of treatment. Some cases I began, others I treated, as they had been started by other students, and other cases I retained. I saw cases in all stages of treatment, and I believe that is as near practical as you can have a clinic, and one which fulfills every need.

Dr. Ottolengui.—I am afraid that some of the gentlemen do not understand the situation in New York. While the First District Dental Society has been giving courses in orthodontia, they were study classes and orthodontia was but one of many subjects taken up in this matter for men who desired to hear lectures on special subjects delivered by experts. In orthodontia, there has never been any clinical work done and there never was any intention of stamping those who attend the lectures as qualified to practice as orthodontic specialists.

Dr. W. C. Fisher, New York City.—I am a student of orthodontia, while you are specialists. I consider that a man who desires an education in the present day in any science can get it. I do not think I have missed a meeting of this society for eight years or more. I come here in order to improve myself in the knowledge of orthodontics, and I have never left a meeting of this society without carrying away a good deal. I am surprised in these eight years I have not found more students of orthodontics at these sessions. Where the fault lies, I do not know. The lack of attendance is not due to the society not extending invitations. The first meeting I attended I was given the courtesy of the floor, which I have never availed myself of until this moment.

So far as criticizing postgraduate courses is concerned, I do not think anyone here wants to criticize them in a depreciatory manner. They have done excellent work, and must go on doing good work until you can improve them. The whole thing has been summed up by Dr. Waldron when he said that six weeks is good; eight weeks is better, a year is still better, and two years better yet.

Dr. G. W. Grieve, Toronto, Ontario.—This subject of schools has been discussed in this society before, and I think we all appreciate the fact that it is not possible to get all the knowledge we would like to possess in a short postgraduate course. It is a matter of long experience. If we apply ourselves, we gradually get there; but we make a lot of mistakes in the process, and, it seems to me, that this society should get behind a movement by which it is possible to establish a first class school in some large center in connection with a university, to get away from all commercialism entirely. We should try to establish it in some center where it is possible to obtain the services of men quali-

fied to teach in such a school. The course should extend over a year at least, and it should be given preferably in some university or should have some good backing behind it. The time must come when a school must be established along these lines in the right place—in a good university.

I appreciate very much the president's address, and I am glad he brought up the subject because that one feature of it has brought forth the main discussion, and it is an important matter which we must get behind and improve in some way.

Dr. Federspeil.—I appreciate very much the free discussion my paper has elicited. Some of you have misunderstood what I had reference to. My attack was on a class of men who are commercializing orthodontia. I had reference to the dollar school and the dollar orthodontist. It is unfortunate that you should attack this or that school, because if a man has a thorough early training in the fundamental sciences, it is an easy matter for him to master any specialty He is then in a position to concentrate upon the teaching outlined in the curriculum, but the curriculum must be right, it must be broad and comprehensive and not limited to the advertising of a system or a man. I remember when I took my course in the Angle School of Orthodontia, we were supposed to use the author's appliances only, consisting of clamp bands, an expansion arch, and ligatures, with little or no knowledge of retention. It took me ten years to unlearn what I learned in six weeks.

This society has taken the lead in raising the standard of orthodontics; it is, after all, a postgraduate school; therefore, I would like you to be more democratic and charitable and to assist those who are weak in orthodontics. That is the purpose of our organization.

ORTHODONTIC APPLIANCES IN THE CORRECTION OF ALVEOLAR CLEFTS AND IN EMERGENCY TREATMENT IN WAR

By H. C. Pollock, D.D.S., St. Louis, Mo.

ORTHODONTIC mechanical devices have been used in the past for the correction of alveolar clefts. Along with many other illustrations, Major V. P. Blair, M.R.C., U.S.A., in the third edition of his book on "Surgery and Diseases of the Mouth and Jaws," illustrates a case (Figs. 1 and 2), in which crude, but

A *B* *C*

Fig. 1.—The first cast (*A*) shows a wide unrepaired cleft at the age of eighteen months. The cleft is partially filled by a transverse part of the nasal septum that would prevent the maxillary bones from being drawn together. At the first operation this transverse part of the nasal septum was removed and the palate repaired by a von Langenbeck operation. As a result of the traction of the soft tissues across the bony cleft the palate became narrower, shown in cast (*B*) made three months later, but there was still a wide alveolar separation. Dr F J Brockman constructed the orthodontic appliance shown on cast (*B*), with which, by means of an elastic band, the alveolar cleft was closed in two weeks, as shown in cast (*C*). Then the lip repair was made.

effective, orthodontic technic was employed in the correction of an alveolar cleft in an infant.

Orthodontists have realized the possibilities of orthodontic equipment in these cases; but it has been left for the war surgeons and dental surgeons to devise ingenious appliances of various kinds to meet their requirements for emergency treatment at the front.

A *B* *C*

Fig. 2—Showing the obliteration of the alveolar cleft by means of an expansion arch by Brockman. Fig. 2-*C* shows the final lip repair over the closed alveolar cleft.

No surgical truth has received greater emphasis in this war than the necessity of correlating the skill and the knowledge of the general and the dental surgeons in the treatment of the combined injuries of the face and jaw bones.

In his book Dr. Blair points out and illustrates the various technical and mechanical devices that have been developed during the war for meeting the requirements of the dental and oral surgeons on the field. Competent technical assistance for those who have sustained injury of the face and jaws is most essential now.

The International Journal of Orthodontia

PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 801-807 Metropolitan Bldg., St. Louis, Mo.

Foreign Depots—*Great Britain*—Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

Subscription Rates—Single Copies, 30 cents. To anywhere in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $3.00 per year in advance. Under foreign postage, $3.40. English price: 15/ per annum, 1/6 per number. Volume begins with January and ends with December of each year.

Remittances—Remittances for subscriptions should be made by check, draft, postoffice or express money order, or registered letter, payable to the publishers, The C. V. Mosby Company.

Contributions—The editor will be pleased to consider the publication of original communications of merit on orthodontic and allied subjects, which must be contributed solely to this journal.

Opinions—Neither the editor nor the publisher hold themselves responsible for the opinions of contributors, nor are they responsible for other than editorial statements.

Reprints—Since it is not desirable to hold type standing longer than absolutely necessary, all requests for reprints should be made at time of submitting manuscript for publication. Rate card will be sent with galley proof.

Communications—Contributed articles, illustrations, letters, books for review, and all other matter pertaining to the editorial department should be addressed to the Editor, Doctor Martin Dewey, 25 East Washington Street, Chicago, Ill. All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 801-807 Metropolitan Building, St. Louis, Mo.

Illustrations—Such halftones and zinc etchings as in the judgment of the editor are necessary to illustrate articles will be furnished when photographs or drawings are supplied by the authors of said articles.

Advertisements—Objectionable advertisements will not be accepted for publication in this journal. Forms close first of month preceding date of issue. Advertising rates and sizes on application.

Change of Address—The publishers should be advised of change of subscriber's address about fifteen days before date of issue, with both new and old addresses given.

Nonreceipt of Copies—Complaints for nonreceipt of copies or requests for extra numbers must be received on or before the fifteenth of the month of publication; otherwise the supply is apt to be exhausted.

Entered at the Post Office at St. Louis, Mo., as Second-Class Matter

EDITORIALS

A Word of Caution in Regard to the Use of Wire-Stretching Pliers

SEVERAL years ago when Angle gave the wire-stretching pliers to the orthodontic profession, very few men accepted them as an important adjunct to the principles of practice. The possibility of increasing the length of the wire by pinching it, thereby exerting pressure upon malposed teeth, did not receive very much attention, except from Angle, until employed by Lourie, of Chicago.

Lourie carried the use of the wire-stretching pliers to a higher degree of efficiency, and demonstrated that the force of a pinched wire is capable of obtaining a great degree of tooth movement and producing results equally as satisfactory, in many cases, as can be obtained by any other appliance. To make the instrument more efficient, he made some changes in the design and began producing types of tooth movement which, up to that time, had not

been considered possible with the use of the wire stretchers. The results which he has obtained and the ease and comfort with which the patients wear these appliances have led a number of men to take up the use of this plan of treatment.

However, at the present time we believe a word of caution should be issued in regard to the use of the wire-stretching pliers in order that others may avoid some of the difficulties which we have observed some have encountered.

In the first place, in order to obtain a satisfactory use of the wire stretchers, the operator must be familiar with the instrument and know the mechanical principles upon which it works. In order to become familiar with the use of the pliers, we would suggest the construction of technical arches upon models, and experimentation upon these technical arches in order to observe the results obtained by the use of the wire-stretching pliers. We believe that a number of men place lingual arches upon teeth in an attempt to produce movement by using the wire-stretching pliers before they have mastered the technic of the pliers or become familiar with the technic of lingual arches.

We believe that the same line of technical experimentation should be carried on with the use of the wire-stretching pliers that is followed in any other line of dentistry. Hardly anyone would attempt to make a plain band before experimenting and soldering the band, nor would anyone attempt any other line of dental operation without having a technical education along that particular line. Therefore, we believe much harm will be avoided, and much more satisfactory results obtained, if men will make technical arches for their cases, and experiment upon them with the wire-stretching pliers before they attempt to get practical results.

The wire-stretching pliers consists of two beaks, which are so shaped that they will be parallel and that they will close parallel over certain gauge wire. We would caution the profession that a wire-stretching pliers which has been manufactured with adjustment for use on a 19-gauge wire will not work satisfactorily on a 17- or 18-gauge wire. The reason for this is that at the completion of the pinch, the beaks must be exactly parallel to produce the greatest efficiency. It must be further remembered that to have a wire that has been pinched remain perfectly straight, the beaks must pinch the wire parallel to each other; second, they must be put at right angles to the wire; and, third, the beaks must be the same diameter. Care must also be taken to avoid moving the handles of the pliers in any direction during the time the wire is being pinched. A movement of the pliers in any direction during the pinching of the wire will result in a change in the shape of the wire, which will produce tooth movement very often undesirable.

Wire-stretching pliers may have the beaks plain or grooved, but in either case the beaks must possess the parallelism that we have mentioned previously. Lourie places a groove, or notch, in the end of the beak to increase the efficiency of the wire-stretching pliers. This groove must be so placed as to grip the wire, and the grooves must be opposite and parallel to each other and consist of equally curved surfaces. The groove also assists in placing the parallel beaks of the pliers at right angles to the wire which is to be pinched. The wire-stretch-

ing pliers are to be used to pinch a wire that lies close to the surface of the tooth, and it must necessarily follow that the notches in the beaks must be so near the end of the beaks that the concave surface will be in the center of the wire and not on either the buccal or the lingual side.

It does not make any difference what kind of wire-stretching pliers is used, whether the beaks are plain or grooved, but the beaks must be parallel to each other at the time of the finishing of the pinch. In other words, pliers must be so constructed that the beaks will not close entirely; and, if adjusted for a 19-gauge wire, the beaks must be parallel at the finish of the pinch or when they have reached their greatest efficiency. If operators are using different gauges of wire for the lingual arches, it necessarily follows that they must have different pairs of pliers adjusted for the different gauges, according to the rules we have outlined. It must also be remembered, when pinching the wire, both ends of which are soldered to a band, not to make too many pinches at one time. The wire-stretching pliers should make pinches at different points on the wire, and, after the surface of the wire has been covered by those pinches a certain distance from each other, one can then go back and place pinches in between those already made. Owing to the fact that the beaks of the pliers are only parallel at the time of the closing, the greatest degree of efficiency will be obtained in making the pinch always the same depth, because, if made shallow, more of an indentation will be made on one side of the wire than on the other, and, therefore, will have a tendency to curve the wire.

We would also caution those who purchase wire-stretching pliers to see that the beaks are so shaped that the sides are parallel to each other, or, in other words, are cylinder-shaped beaks, not cone-shaped beaks. The handles must also be adjusted by a set-screw, the beaks filed, or dressed down, until they are parallel to each other at the finish of the pinch. After the pliers have been set to fit a certain sized wire, it should be used only on that sized wire.

We believe that by following these few basic principles and mastering the use of the wire-stretching pliers on technical models and technical arches, better results will be obtained than if we attempt to use the pliers, without becoming familiar with the mechanical principles employed and the peculiarity of a pinched wire, the ends of which are soldered rigidly to the bands.

Section of Surgery of the Head

THE medical care of one million troops in the field will require the services of several thousand physicians. The Medical Corps of the regular army, one of the most carefully selected organizations of medical men, was not sufficient for the present emergency. Primarily, the corps was augmented numerically by the organization of the Medical Reserve Corps. By a careful distribution of the men of the regular corps, the influence of their long and thorough training permeated the new organization, forming a completed organization in which those inexperienced in military medicine were safely supported. The Medical Reserve Corps organized, the profession realized its responsibility, and,

in consequence, commissions were issued to a large number of physicians throughout the country.

Many of the members of the Medical Reserve Corps were detailed to various Medical Officers' Training Camps for the purpose of intensive technical and physical training. This assignment afforded the officers opportunity to obtain physical fitness and sufficient military experience to qualify them as regimental, ambulance, and sanitary officers. It also permitted the weeding out of the physically unfit, but did not afford opportunity to classify officers according to their professional attainments. The details of this training so consumed the time of instructors and students that it was impossible to judge of the fitness of the officers for special work.

Recognizing the need for specialists, the Surgeon-General, with the General Medical Board of the Council of National Defense, through the great medical bodies of the country, established in his office sections for the care of the various medical and surgical specialties. Physicians of high professional rank, many of them authorities in their chosen field, and in civil life acknowledged leaders, were selected to direct these sections. This plan of classifying the personnel of the military medical corps, a new departure, is another example of the far-sighted preparation now so conspicuous in every branch of the service.

The various needs of the service demanded the establishment of eight sections; namely, Internal Medicine, General Surgery, Orthopedic Surgery, Venereal, Skin and Genito-urinary Surgery, Surgery of the Head, Laboratories and Infectious Diseases, Neurology, Psychiatry and Psychology, and Roentgenology.

The Section of Surgery of the Head, made up of the Subsections of Ophthalmology, Oto-laryngology, Plastic and Oral and Brain Surgery, developed from a similar organization of the General Medical Board of the Council of National Defense.

In the office of the Surgeon-General, the section as a whole is under the direction of a Lieutenant-Colonel of the regular corps, and to each subsection is assigned a member of the Medical Reserve Corps. These officers act in an advisory capacity in the selection of personnel, etc., and outline the policies under which the work is to be carried on.

Those in charge of Ophthalmology and Oto-laryngology found their chief function in acquainting the physicians of the country with the fact that the Surgeon-General was desirous of using the specialist, as far as possible, in his specialty, and in listing the names of the physicians who came into the Medical Reserve Corps with a view to work in their specialty. They have aided the Surgeon-General to select and assign the proper personnel to the base hospitals at the various cantonments. At the present moment, the selection of the personnel for the base hospitals, which are destined eventually for duty abroad, engages their attention.

The officers in charge of the Subsection of Plastic and Oral and Brain Surgery were confronted with the fact of the great scarcity of surgeons familiar with the special technic so necessary in the successful management of injuries of the face and head. It was necessary to use this small group of qualified surgeons to instruct others, and thereby build up a corps of sufficient size to enable

assignment of specially trained surgeons to the various hospitals. A conference of the recognized authorities, held in Washington, developed the fact that the large universities were willing to assist in this professional training by tendering to the Surgeon-General the facilities of their medical departments and hospitals.

Schools, with teaching staffs of surgeons versed in the details of special branches were established. The course of instruction includes anatomy, physiology, symptomatology, operative exercises on the cadaver and animals, splint making, clinical demonstrations, and didactic lectures.

In the selection of students, the Subsection of Plastic and Oral Surgery first considered a group of surgeons commanding excellent technic, but lacking in the necessary special refinements; secondly, the members of the dental profession, many having medical degrees, who have concentrated their studies upon peridental tissues, the jaw bones and structures of the mouth, and consequently familiar with the special details of the treatment. The correlation of the technic so as to enable the individual surgeon to command the combined knowledge can well be accomplished in these courses.

In a like manner the successful neurologic surgeon must, in addition to his general surgical training, have some knowledge of neurology and be trained in the special technic of surgery of the nervous system. The imparting of this special training could best be accomplished by similar schools. With the assistance of the leading members of the profession throughout the country, a list of candidates for these schools has been compiled. These candidates, in groups of twenty-five are assigned to the schools for a period of intensive fundamental training. When this course is completed, it is planned to give the more competent surgeons an opportunity to continue studies in the various clinical centers of the country. Selected groups of these officers, well-grounded in the fundamentals, can later be more specially qualified through a course of clinical instruction at the front.

In this manner the important period of preparation so necessary for the accomplishment of rapid expansion of all branches of the service, will be most wisely used.

When the troops are engaged and many beds of the various hospitals are occupied by soldiers with injuries of the head, assignment of these surgeons, who have had special training, to assume the responsibility of these cases should result in the utmost efficiency. In the unit for plastic and oral surgery a general surgeon will have associated with him a dental oral surgeon, who, having gone through a course of intensive training, will be fitted to obtain the very best results through their correlated skill. Likewise the officer of the Subsection of brain surgery, necessarily somewhat divorced from the competent neurologist, will have keen judgment and undertake with clearness his responsibility.

The fact is evident that it is not the intention of the Surgeon-General to make special surgeons by means of a short course of instruction, but add the necessary special knowledge to the equipment of surgeons. This special knowledge will not interfere with the general usefulness of the surgeon in the performance of any duty which may fall upon him as a member of the Military Medical Corps.

D. Willard Flint, D.D.S.,

President of the American Society of Orthodontists

The International Journal of Orthodontia
Editor: Martin Dewey, D.D.S., M.D.

VOL. III ST. LOUIS, DECEMBER, 1917 No. 12

ORIGINAL ARTICLES

MODERN PRINCIPLES AND METHODS IN ORTHODONTIA*

BY CALVIN S. CASE, M.D., D.D.S., CHICAGO, ILL.

IN response to the very kind invitation of your program committee to present a paper and a clinic before this society and wishing to avoid so far as possible subjects of a former controversial nature, which time and the cooperating forces of experiences are the true molders toward truth and progress, I have concluded that I can not bring to you anything that will be of greater interest, especially to the younger members of this society, than the well authenticated history from the very start to the finish of some typical case that is not uncommon in practice, and which requires a number of distinctive characters of movements and appliances for its correction and retention. This will give me an opportunity to call your attention to some of the most modern principles and technics employed in my practice and teaching for the correction of malocclusion. Then as an interesting and perhaps instructive supplement to the paper and its illustrations, the case will be continued at my clinic, which will give an opportunity to those who desire to more closely examine the stock material and the finished appliances set up on the models, showing different stages of the case, and every detail in regard to material, sizes, technic construction, assembling, adjustments and application of the various forces of correction, and retention.

The case which I have chosen to present for this paper is one of peculiar interest and applicability, because, in the first place, it teaches the importance of a careful and thorough study of every case, however apparently simple and uncomplicated it may at first appear, and why an artistic observation of the facial outlines should be regarded as one of the foundation principles of intelligent diagnosis.

*Read before the Seventeenth Annual Meeting of the American Society of Orthodontists, Excelsior Springs, Mo., Sept. 5, 1917.

Second, it shows how, from the local cause of adenoids, followed with long continued early mouth-breathing and inhibited maxillary development, may arise three distinctive characters of malocclusion; i. e., decided malalignments of the permanent teeth, open-bite or infra-occlusion of the front teeth, and finally a bodily retruded position of the upper incisors and entire intermaxillary process.

Third, it will conclusively demonstrate the remarkable effectiveness of the resilient forces of exceedingly light arch bows and delicately constructed bands and unique attachments, which have been aptly termed the *midget appliances*, and which are particularly adapted for the correction of the common malalignments of children's teeth.

Fourth, it will show the most modern technic and application of the regular bodily movement apparatus whose principles of force have been successfully employed for twenty-five years for the correction of the most extensive retrusions and protrusions. This was named the *contouring apparatus*, because of its early surprising capability of developing and correcting depressed facial contours through a bodily labial movement of the front teeth. It was afterwards discovered that this same principle of applying force to the teeth, according to the law of levers of the third kind, was quite as applicable for bodily lingual movements of the front teeth; and in recent years this same mechanical principle has been extensively employed for bodily movements of the teeth in every direction. In fact, no teeth were ever moved bodily except through the application of this principle of force, which consists in the establishment of independent points of fulcrum and power in relation to the alveolus or area of work. Even that valuable addition to our technic principles of torsional force for the bodily movements of teeth, presented recently by Angle, and exemplified in his new appliances, is deducible in its direct action to that of a lever of the third kind.

Fifth, this case will also present an opportunity to examine at the clinic the most modern methods in the technic construction and action of the regular bodily *working* retainer, it having been necessary to remove the regular bodily movement apparatus before its work was completed, as will be more fully explained.

Sixth, you will also have an opportunity to examine the regular six-band retaining appliance similar to those that have been employed in nearly every case in my practice for over twenty years.

As Dr. Carl Case has kindly consented to assist me at my clinic, if facilities and time are offered, we hope to show the technic construction of this appliance.

The case referred to is that of a girl, about thirteen years of age. The first impressions, the plaster casts of which are shown in Fig. 1, were taken Sept. 27, 1916. Both right and left sides were so alike in buccal occlusion it is unnecessary to show but one side, as you will see by other views. It will be noticed in examining the buccal occlusion that the upper denture is slightly distal to normal, and that the upper incisor teeth, though appearing to be prominent at their occlusal edges, their roots are decidedly retruded, being labially inclined from deepened incisive fossæ. The apparent prominence of the upper incisor crowns is enhanced because of the retruded malposition of the lower incisors, which is due to the unfortunate extraction of a lower lateral incisor, which I am told occurred

soon after its eruption in lingual malalignment. From the facial cast it can be seen that the chin and lower lip are quite perfectly posed, and in harmonious relation to the main or unchangeable features of the physiognomy, showing that the mandible and lower denture are in normal relations. The moderately retruded outlines of the upper part of the upper lip with the abnormal deepened nasolabial lines, enhancing the prominence of the cheek bones, gave to the physiognomy, especially from a front view, an unnatural and decidedly unesthetic broad and flattened appearance. The facial diagnosis, in connection with the

Fig. 1-*A*.

Fig. 1-*B*.

retruded relations of the upper incisors and marked open-bite malocclusion, definitely indicates that its cause was early adenoids and mouth-breathing—the former inhibiting the normal development of the maxilla, and the latter, which doubtless continued through several years of early development, resulted in the open-bite malocclusion.

From the above diagnosis it will at once be observed that the case belongs in Class III of the dento-occlusal classification, and that the main and imperative part of the operation demands a bodily labial movement of the upper incisors

and incisive alveolar process, accompanied by a general maxillary enlargement through bone growth development, to correct dental and facial relations.

In all cases in which a bodily movement of the front teeth is demanded, it is first quite imperative in my practice that they be placed in alignment so that they can be brought evenly within the firm grasp of the power arch bow, and thus moved bodily in phalanx.

For the purpose of accomplishing this first stage of the operation, and incidentally to correct the alignment of the lower teeth and open-bite malocclusion, I first employed the apparatus shown in Fig. 2, which is similar in general character to that which has been commonly employed in my practice for years, for the correction of all simple irregularities in alignment and malposition of the teeth of children and youths. It is that which derives its main motive force from the resiliency of very light arch bows which range in diameter sizes from Nos. 22 to 26 (.025″ to .06″). To those who are not familiar with the gauge sizes, it may be well to state that No. 22 is about the size of a small pin, and No.

Fig. 2.

26 is but a trifle larger in diameter than the thickness of a 28 gauge plate with which all of you are familiar.

There is no objection to employing any of the alloys of gold and platinum for the arch bows, if specially drawn; but for all intents and purposes 18 per cent nickel spring German silver wire if properly drawn, will answer every requirement. Few orthodontists, who have not tested the possibilities of high grade German silver, can realize the high degree of spring temper and resiliency that can be given to arch bows of this material when drawn *cold* from very much larger sizes.

The arch bows of the above small sizes, if intended for the purposes referred to, should be drawn from No. 14 or No. 16 high grade spring German silver wire, without annealing, and kept cold in the process with a small bag of pounded ice over the drawn plate.

The particular characters of malocclusion for which these very light resilient arch bows are especially adapted, are those which are commonly composed of a variety of malpositions that arise during the early eruptive stages of the permanent teeth, and which are commonly due to local causes. I need not enter into

extensive detail in regard to these midget appliances or the technics of the delicate bands and attachments here, as this was fully published in the April, 1917, number of the *Dental Items of Interest.* Nor can they be appreciated without seeing the appliances, and noting with what ease and facility the treatment adjustments can be accomplished. In the apparatus here shown the arch bows are No. 26. The bracket attachments on the lower incisors—which will be better shown by an examination of the appliances—are for direct intermaxillary

Fig. 3 *A.* Fig. 3-*B.*

elastics to aid in closing the open-bite. After this apparatus was placed on the teeth, and the patient instructed in the adjustment of the elastics, I did not see the case oftener than once in two weeks. Occasionally at these times, the arch bows were removed and replaced with fresh ones, and minor treatments performed as the changing conditions demanded.

In less than four months after these appliances were attached, the upper front teeth being sufficiently in alignment for the bodily movement apparatus, they were removed and impressions were taken for the models shown on the right of

Fig. 3. On the left is a view of the beginning models. Then the upper contouring apparatus, as shown in Fig. 4, was made and placed. The power arch bow in this case is No. 16 spring German silver rolled to a ribbon form of about two-thirds its diameter over the labial area, and placed to apply its force at the gingival line of the front teeth, and not upon rootwise extensions. For younger patients, I now rarely apply the power above the gingival margins, and I often place the fulcrum bow near to the middle of the crowns. It must be seen, however, that the further the line of power is placed from the area of alveolar work, and the nearer it is to the artificial fulcrum, it proportionately decreases its mechanical advantage for bodily movement, and consequently increases the strain upon the power arch bow and its molar anchorages.

The only object in applying the power upon rootwise attachments to the front teeth is to increase the mechanical advantages of the whole apparatus, which is quite important when extensive bodily movements of front teeth are demanded for older patients.

Those who find it difficult to construct the upright attachments on the upper

Fig. 4.

incisors in which the power bow rests back of the uprights, may prefer, for young patients, to employ open tubes to clasp around the bow, or hooks which lap over it, both soldered to the bands at the gingival margins.

If they wish to combine the torsional bodily force with this, they can easily construct the hooks to exactly fit a ribboned portion of the power arch bow which is rolled at such an angle that when placed in its front attachments the distal ends of the bow, at equilibrium, will stand below the occlusal plane, making it necessary to lift them to their positions in the U-tubes, as illustrated in my article in the *Dental Items of Interest.*

I would advise, however, from some experience I have had with this method, that the fulcrum bow be not omitted, and the power bow be not less than No. 19. I hope this will not be regarded as an adverse criticism of Angle's new appliances of which I have no right to judge from an experienced standpoint.

The amount of correction at this time, of the infra-occlusal position of the front teeth shown by the front occlusal models in Fig. 3, was accomplished mainly by direct intermaxillary elastics attached to the midget hook and bracket attachments upon the front teeth.

At the anniversary clinic of the Chicago Dental Society, Jan. 27th, 1917, four months after beginning the operation, the patient, attended by her older sister, kindly consented to appear and patiently submitted to hours of examination and questioning by hundreds of dentists. She was wearing at that time the upper contouring apparatus shown in Fig. 4, a duplicate of which you will have an opportunity to examine. The plaster dental and facial casts and the mounted apparatus which had accomplished its work up to that time, were shown and explained. I am particular to mention this circumstance—parenthetically—because it establishes the unquestionability of the above dates. I wish to say also, the appliances and models of this case were employed to partly illustrate a paper which I read before the Southern Dental Clinic at Atlanta in March, 1917, and no doubt will be published with the proceedings of that meeting.

You will pardon me for saying that I hesitated in presenting the true chronological history of this case for fear that some one might imagine that I regarded rapidity of orthodontic movements as the test of the value of methods. Whereas, it will be found throughout my entire teaching that that particular phase of an operation is negligible compared to the selection and application of methods which are best suited to the needs of the case in hand; and which will accomplish the most favorable results. In fact I doubt if the best accomplishments can be attained in the correction of many cases of malocclusion in an attempt to hurry the operation. While time, ease of adjustments, painlessness, nonirritability and artistic effects are of great importance, they should never stand in the way of truer principles of practice, even though lacking in some of these most desirable qualities. Occasionally, as in this instance, we will meet with cases which safely respond with phenomenal rapidity, if the forces are skillfully adjusted to their needs.

The second lower apparatus, which is shown in Fig. 4, was placed a few weeks after the patient had become accustomed to the upper. The lower front teeth were now nearly in alignment and consequently in a position to be more firmly grasped by a No. 23 expansion arch bow which would sustain, with greater stability, the distances between the molars and the front teeth and exert a slight general expanding force, and at the same time permit the proper action of the disto-mesial elastics for the reinforcement of the upper anchorages and the adjustment of the occlusion. Provision will be seen on the lower for the direct intermaxillary elastics to continue the extruding force—particularly the upper canines and premolars.

I do not wish it to be inferred that the forces of any of these appliances alone were the only treatments employed, because in this, as in nearly every case, the skillful orthodontist will employ subsidiary forces as the case progresses, which are quite as important as the main forces for keeping the machinery in perfect coordinating action. I obtain these side forces mainly with light silk ligatures and elastics. Moreover, it is the rule in my office that when bands or their attachments have outgrown their usefulness, or they are not properly constructed or adjusted to perform their best work, they are immediately removed and corrected—more often with new bands and attachments for varying the force.

There is one thing to which I wish particularly to call attention as one of the

recent and most important improvements in the technics of anchorages. It is the employment of the U-tubes instead of closed or seamless round tubes for the ends of the arch bows. For the very light resilient bows a seamless tube on one side and a U-tube on the other is usually sufficient. But for larger bows, with locked attachments to the front teeth, which are designed to exert a lateral expanding force, and especially those which are intended to exert a bodily torsional expanding force, U anchorage tubes are invaluable, because they enable giving to the bow any desired spring force, and with assured ease of assembling. And then when desired, the ends can be readily lifted from the U-tubes and given an extra spring force and replaced without the necessity of unlocking the bow from its front attachments. This is especially important for the more rigid power arch bows of the contouring apparatus. It occasionally becomes necessary to

Fig. 5-*A*.

Fig. 5-*B*.

remove these bows to increase or decrease their expanding properties, or to correct some irritating action that arises at the front. Formerly this was impossible without a complete removal of all the front bands or the stationary anchorages, which is not always a very easy operation without slitting them. Now the countersunk nuts which lock the ends of the bow in the U-tubes are unscrewed and the bow is easily lifted out of its attachment at the back and then at the front, and as easily replaced, without disturbing any of the bands.

There is another important improvement of somewhat recent date in the technics of anchorages where great stability is demanded. In addition to the invaluable advantage of the two or three band stationary anchorages, this more recent improvement consists in applying the anchorage power above the gingival margins upon rootwise anchorage attachments, shown in Fig. 4. This places the direction of power more nearly in a line with the center of alveolar resistance, and proportionately increases the stability by decreasing the tendency to inclina-

tion movement. The rootwise method of applying force is invaluable in all bodily movements. Besides the labiolingual bodily movement of the front teeth, it is of great advantage in the bodily expansion of dental arches, and in bodily disto-mesial movements of both the front and back teeth to close interproximate spaces, from whatever cause, where it is important to avoid inclination movement.

Fig. 5 illustrates an appliance that has been constructed to show how a combination of torsional and rootwise forces may be employed in the bodily expansion of arches. The arch bow in this appliance is No. 19 special spring German silver, rolled distal to the canines, to a ribbon form of about two-thirds its diameter in thickness, and at an angle, in equilibrium, that will twist the ends of the bow one-quarter to one-third the way around when sprung into the U anchorage tubes, and in a direction so that the force of the upper, or rootwise edge of the ribbon will be exerted in a buccal direction. The lingually directed force of the lower edge is supposed to be more than neutralized by the direct expanding force of the bow.

This method has never been tried in my practice, but I have no doubt that

Fig. 6.

it is of considerable value, providing the arch bow is sufficiently large to exert the requisite force. Up to the present time, I have been fairly successful in the bodily lateral expansion of arches by applying the force upon rootwise extensions.

To return to the case under consideration: after the bodily movement apparatus had been worn about four months, I was informed that it would be necessary for the patient to return to her home in Oklahoma on account of the sickness of her father, and that I probably would not be able to see her but a few times until near the close of the operation. As the bodily movement of the upper teeth and the general correction of the malocclusion had progressed quite favorably, and fearing to trust to others in this advanced stage the treatment adjustments, I decided to place the bodily working retainer on the upper incisors, which would continue, more slowly but safely, their bodily movement.

Fig. 6 shows two views of the working retainer on the model of the upper teeth at this time. The lingual push bars are No. 19 spring German silver, fitted but not soldered into the thick-wall clasp-metal tubes which are attached to the clasp metal reinforcement-backing of the retainer. The distal ends of the bars at equilibrium are about 3/8 of an inch below the occlusal plane, and when sprung into the U-tube attachments on the lingual surfaces of the stationary anchorages, exert a labial force upon the roots of the incisors; which, in connection with the

action of the nuts at the mesial ends of the anchorage tubes, results in a bodily labial movement.

The object of the two-band stationary anchorages is to distribute the extrusive spring force of the bars and prevent a supra-occlusal movement, as would naturally occur if this force were sustained by single molar anchorages. The

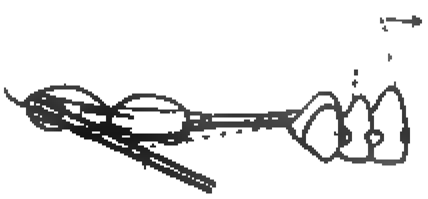


Fig. 7

Fig. 8.

Fig. 9

disto-mesial and direct intermaxillary and other forces were continued with this apparatus.

As stated in my textbook published in 1908, and illustrated with the drawing shown in Fig. 7, and also in a paper read before the Orthodontic Society in Paris in 1914, there is no reason why this bodily movement working retainer should

not be employed for many of the bodily labial movements of children's teeth, and in fact in all cases for young patients when the required movement is not extensive. It certainly has the very great advantage of inconspicuousness, and non-irritability to the lips. It admits also of perfect cleanliness, and like the six-band retainer, is, in my opinion, far the most artistic orthodontic appliance I have ever constructed.

During the absence of the patient, she very faithfully kept up the application of the various forces. She returned to me about two weeks ago. On Wednesday, Aug. 29, 1917, eleven months after starting the case, all the appliances were removed, and the impressions were taken for the plaster casts shown in Fig. 8. Notwithstanding the unfortunate fact that there are only three lower incisors, the dentures are in fair occlusion, which time will improve. Below is a front occlusal view of the teeth in which is faintly shown the final retainers in position. One may be able to see the supplemental spurs for the attachment of the direct intermaxillary retaining elastics for containing the extrusive force to prevent a return of the infra-occlusal position. Also the hooks on the lower for containing the disto-mesial intermaxillary force.

Fig. 9 will give a fair idea of the development in the facial outlines by immediate comparison with the beginning facial cast on the left. The plaster impression for the one in the middle was taken upon the removal of the regular bodily movement apparatus which was worn about four months. The impression for the one on the right was taken about one week ago.

When you come to examine the plaster dental models of the upper, made at this time, you will see that the roots of the incisors are abnormally prominent in relation to the alveolar process, especially above the ends of the roots. Therefore, if the upper incisors are retained in their present bodily labial position, the facial outlines will, no doubt, continue to improve through stimulated growth development.

DISCUSSION

Dr. C. A. Hawley.—Mr. President and Gentlemen: I am very sorry to be asked to open the discussion on Dr. Case's paper without having had time to read it carefully and give the matter more mature consideration, and I hope that anything I may say will be considered from that standpoint.

Anything that Dr. Case presents to a body of orthodontists is entitled to most careful and favorable consideration. We all know the work he has done for orthodontia and the long years he has devoted to the work. The results he has obtained in this case, it seems to me, are almost above criticism. One feature in the case has interested me very much which he has not made very much of; namely, beautiful occlusion of the teeth, and still the patient lacks one incisor. That is a matter perhaps Mr. Hanau could explain to us. He has been giving the matter for the last three or four years a great deal of study. I am very much impressed with the results that have been obtained with these very delicate appliances which Dr. Case has shown.

Dr. Case.—There is much in the illustrations of the paper which will be far better shown at my clinic. I have with me all the appliances showing the special attachments, and how they are placed and soldered. You will have an opportunity to see how readily and effectively the forces are applied and changed; and with what ease and rapidity these small resilient bows are wound in and out along the line of attachments from the U-tubes on the molar anchorages; and then after they have been worn a week or two, how readily they can be removed and replaced with new bows.

Dr. Lischer.—Why do you put on a new one?

Dr. Case.—Of course, you can easily straighten the original one, but they are so easily made and so inexpensive, if of German silver, one would hardly take the trouble. The action of this force, as in all resilient elastic forces, no doubt, has a great tendency toward stimulating the activities of bone growth development; especially is this noticeable in those cases of narrow arches during the early stages of secondary dentition where there seems to be insufficient room for the eruption of the incisors between the deciduous cuspids. In many of these cases where it would seem as if the spring of the bow would tend to drive the cuspid area into the arch and thus prevent labial area enlargement, it absolutely acts in the opposite direction. By forcing the lingually malposed teeth into line, they are made to act as expanding wedges, together with the renewed stimulation of growth, the arches are seen to assume the required proportion for the normal eruption of the permanent teeth.

Dr. L. S. Lourie.—I would like Dr. Case to explain the attachment of this fine expanding wire he uses. I did not get a chance to read the article in which Dr. Case mentions the use of this expanding arch. I would like to have him explain it in more detail. I was away from the city at the time the article was published and I did not see it, but I have heard those who have seen the appliance say that the little spring arch he uses is not fixed to the individual teeth. Am I right?

Dr. Case.—Yes.

Dr. Lourie.—That is an important point which should be emphasized in this article of Dr. Case's, and it will bear repetition because it is important. I believe it is a great improvement over the forms of thin arches such as the Angle ribbon arch or the Robinson appliance in which the arch is definitely fixed to each tooth. You have the reciprocal force of the spring. The spring as it acts has a changing reaction on all teeth, whereas with Dr. Case's model, the arch is not rigidly attached to the various teeth by means of the band, and allows the teeth to slightly adjust themselves as the spring changes. By not having the teeth rigidly attached to the spring arch, they are not so apt to be moved into positions not desired as a result of the reaction from some other tooth.

Dr. R. Ottolengui.—If I am correct in my understanding, I would emphasize the fact that by only using the arch once and starting every time with a new one, you are not complicating your work with the previous bends the same as when you use one arch all the time and endeavor to make new bends do new work.

THE THERAPEUTIC EFFICIENCY OF ORAL PREPARATIONS*

By Hermann Prinz, A.M., M.D., D.D.S., Philadelphia, Pa.

Professor of Materia Medica and Therapeutics, The Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania.

ORAL HYGIENE

THE science of oral health treats of the preservation of the normal equilibrium of the oral cavity and its contents. The remedies intended for the maintenance of the health of the soft structures of the mouth and the teeth may be conveniently divided into those prescribed for specific diseased conditions and those employed as hygienic measures for daily use. In the mouths of most civilized races, the mucous membrane, on account of the present perverted methods of preparing and seasoning our foodstuffs, is found more or less always in a state of mild chronic inflammation, while the hard structures of the oral cavity, the teeth, are subjected to a process of molecular destruction known as dental caries. Dental caries is not a disease in the same strict sense of the word in which the latter term is usually applied, but is a process distinctly allied, both in its chemical and bacteriologic aspects, to the general phenomena of putrefaction (Goadgy). While certain preliminary intrinsic causes; i. e., anomalies of position, outline and structure, etc., may profoundly alter the predisposition of the tooth to carious destruction as a whole or in part, dental caries will always occur if a tooth is subjected to the influences of suitable environments, and it does not matter whether the tooth forms an integral part of the anatomy of the individual, or whether it is separated wholly or in part from its original owner. The late Miller has formulated an explanation of the nature of the carious process, which, at present, is universally accepted, and which defines this phenomenon as; a chemico-parasitic process consisting of two definite states; i. e., the decalcification of the tissues and the dissolution of the remaining organic matrix. In caries of the enamel, the latter phenomenon is not observed on account of the minute quantities of organic matter contained therein. The accumulation of carbohydrate food debris on and about the teeth is held directly responsible as being the incipient faction in the production of the decalcifying agents. The direct or indirect splitting up of these carbohydrates by fission fungi into acids; i. e., principally lactic acid, furnishes the attacking agent which decalcifies the enamel. The further changes occurring in this process of tooth disorganization do not interest us at this moment.

The hygienic care of the mouth intends primarily to keep the mucous membrane and the teeth in a state of healthy equilibrium by overcoming the above enumerated morbific processes. Nature has instituted protective measures of her own to accomplish the desired end. The normal mouth is fairly well protected against the continual onslaughts of the omnipresent bacteria through an unusually

*Read before the Seventeenth Annual Meeting of the American Society of Orthodontists, Excelsior Springs, Mo., Sept. 6, 1917.

rich blood supply of the oral tissues, a high resistance of their epithelial lining, and a free flow of saliva. The vigorous use of the organs of mastication during the chewing of properly selected food will bring about an active circulation and stimulation of the parts involved, and, as a sequence, a rich flow of saliva required for the washing away of food debris and for the preliminary digestion of carbohydrate food is always insured.

Human saliva represents the mixed secretions from the three pairs of salivary glands and the minute mucous glands distributed over the oral cavity. Saliva may be defined as being a weak solution of alkalies, as present in the body juices, more or less saturated with carbon dioxide. It contains, furthermore, several organic substances, among which mucin and the several ferments which accelerate the changes of starches into maltose; i. e., the hydrolysis of polysaccharides into soluble disaccharides. The ferments of human saliva are principally represented by the carbohydrate-splitting type; i. e., amylase (ptyalin) and maltase, although oxydase and catalase are always present in more or less variable quantities. The physiologic function of mucin consists in mechanically assisting the food bolus in its easy passage into the stomach and to protect the oral tissues against irritating substances.

The biologic laws governing the secretions of saliva are directly responsible for its composition, its quantity, and its influence on the digestion and, incidentally, on dental caries. Only the most fundamental facts concerning these biologic aspects can be touched upon at this moment. The secretion of saliva depends upon nervous impulses. The quantity of saliva secreted, that is, the rapidity of its flow, depends upon the physical nature of the irritant (foodstuffs). Psychic stimulation is of less importance in this connection. Incidentally, the composition of saliva depends very largely upon the rapidity of flow; i. e., its organic and inorganic contents are primarily the sequences as produced by the nature of the irritant. The irritant induces these changes, not merely in the oral mucous membranes, but also in those of the stomach. The latter seems to respond through the formation of hormones. Apparently, as has been shown experimentally by Pawlow and his pupils, saliva is a glandular secretion capable of adaptation. However, the fundamental basis of the secretion of saliva rests with the process of mastication. The degree and the manner of mastication accelerates or diminishes very materially the nature of the irritant. The much discussed alkalinity of saliva depends directly on its ash contents; the more ash the higher the alkalinity. With an increase of the rapidity of flow an increase of alkalinity is always observed. Alkalinity of saliva as determined by titration is always a "one man's" finding and not to be relied upon. To determine correctly the reaction of a fluid which as saliva, hovers so near the neutral point, the electrometric measurement of the H-ion concentration is the only permissible scientific method. The writer has successfully employed for such work the gas-chain apparatus as modified by Michaelis. The reaction of normal saliva; i. e., saliva collected during periods of physiologic rest of the salivary glands, is so very weakly alkaline that its influence as a so-called neutralizing medium of "acidity" of the mouth is practically nil. As the quality of saliva when collected during active digestion is always an expression of the nature of the last meal

taken, saliva intended for analysis should be collected during resting hours of the digestive apparatus. The normal, healthy, grown individual produces during waking hours approximately 1 c.c. of saliva per minute. During mastication, as stated above, depending upon the nature of the foodstuff, this amount may be greatly increased.

Pickerill has made the assertion that the principal function of saliva consists in the hydrolysis of starches and thus prevents dental caries. The writer has not been able experimentally in the human mouth to show any relationship between the amylase (ptyalin) cotent of saliva and dental caries. Amylase may be readily paralyzed or accelerated by many chemical agents. Pure amylase is inactive as a ferment; certain inorganic ions, especially the chlorine ion (sodium chloride), accelerates its activity ten times or more. Normal quantities, or even relatively large quantities of amylase may be, and occasionally are, present in the most rampant forms of caries. In certain animals, as for instance in the domestic dog, very little or no amylase is present in the saliva, although the dog is relatively immune to dental caries.

The much discussed bactericidal action of the saliva, which is claimed to be due to the presence of small and very variable quantities of potassium sulphocyanide, has been disproved by the classic researches of Miller, Bruylant, Gies and Kahn, and Kantorowicz. In a recent paper, McGehee attempts to revive the influence of sulphocyanide in its relation to the causation of dental caries, and, as a proof, he hypothetically quotes from Pauli's interesting little work: "Physical Chemistry in the Service of Medicine." McGehee has wholly missed his point. Dental caries does not depend on the living organism, and, as a consequence, the presence or absence of this chemical in metabolic processes as related to dental caries plays no part. In the normal mouth pathogenic microorganisms are usually less virulent, and they are the subordinates of the saprophytic types. Fluegge has shown that the pathogenic bacteria will become extremely active if the individual is afflicted with a slight local disturbance—as a simple catarrh of the throat. Claermont has expressed similar views, and, after a careful study of the fluids of the mouth, he asserts that one is not justified in stating that saliva possesses any definite bactericidal action. It seems, however, that the parotid saliva of man and of some animals (especially the goat) exercises an inhibitory function on certain microorganisms—the staphylococci and the streptococcci.

Very recently an hypothesis relative to definite defensive or protective organisms possessed or produced by nature to combat the ravages of dental caries has been promulgated by McGehee. This conception is based on the ingenious experimental researches of Abderhalden, who holds the view that diseased processes are primarily regulated by defensive ferments. McGehee's conception is based on a misinterpretation of the Abderhalden theory. As I stated above and wish to state again, dental caries is not a disease; it is a process of putrefaction, which may occur in a tooth, whether this tooth forms a part of the anatomy as a whole, or whether it is detached therefrom. The writer, two years ago, while working on this very question in Abderhalden's former laboratory at the University of Berlin, convinced himself of the fact that defensive ferments, in the

sense of Abderhalden's protective theory, play no part in the process of dental caries.

The fermentative changes of the various types of saccharides into soluble sugars, the mechanical washing away of accumulated food debris, and the ability of biologically inhibiting the virulence of pathogenic bacteria, are the important functions performed by a freely flowing saliva, and thereby maintain the physiologic equilibrium of the oral cavity.

Immunity to dental decay, in the writer's opinion, depends—*cœteris paribus*—first, on a tooth free from imperfections of calcification, and, second, in a freely flowing saliva.

Immunity as referred to tooth structure is, in the strict sense of the word, a misnomer, as it is not bound up with vital phenomena. In a biologic sense, immunity indicates a state in which the "living" body resists disease. In a pulpless tooth, it goes without saying that we are dealing with dead structures so far as the enamel is concerned, and it is this latter tissue only that concerns us in the elucidation of the question: How do teeth decay? In a tooth with a vital pulp, the writer holds the view that enamel is capable of carrying on metabolic processes to a limited degree. He is able to substantiate this claim by certain pharmacologic reactions, which, however, he can not discuss at this moment. The surface of so-called living enamel he regards practically as dead structure which offers no vital resistance to the physicochemical process of decay. The omnipresent surface colloids and the colloidal fluids present in the enamel in teeth with living pulps modify the process of decay. All teeth which are imperfectly calcified on account of their lowered resistance will sooner or later decay until relative immunity is established in accordance with the imperative law of survival of the fittest. If, however, the flow of saliva is impaired or completely checked, all teeth will be destroyed by caries unless some other means for the removal of food debris is established. The rapidity of the destructive processes is proportionally dependent upon the severity of the impairment. Normally, the flow of saliva is regulated by the intensity of the irritant as evinced during mastication. The stimulation by acids is of a temporary nature only, and of less importance. Therefore, vigorous mastication, or, as it is called by a recently popularized term, fletcherizing, of correctly selected foodstuffs forms the basis for the natural prevention of dental decay.

To substantiate our contention relative to the position which saliva occupies in the prevention of caries, we may cite a few examples. In xerostomia, i. e., inhibition of secretion of saliva, the teeth will begin to crumble away with the onset of the dry mouth. During other temporary pathologic disturbances of glandular activity, i. e., continuous fevers (typhoid), menopause, diabetes, etc., clinically a marked increase of dental caries is always observed. The change of environments of food supply, i. e., if the natural struggle for existence in gathering food is supplanted by artificially furnished food of a prepared type, a marked preponderance of dental caries, even in hitherto immune herbivorous animals, is always observed, as, for instance, in monkeys in captivity. The skulls of wild horses very rarely show carious defects; the domesticated horse is in frequent need of the veterinary dentist. Subjecting wild tribes of the human race to the influences of civilization, and, as a sequence, changed food supplies, will always

be followed by a most marked increase in dental caries. Immigrants from countries where hard-baked, black bread forms a large part of their staple diet, when coming to the United States are frequently subjected to intense ravages of dental decay. For instance, newly arrived Scandinavians, accustomed to chewing "knackebrod," forget to masticate our soft wheat bread, and, as they are often forgetful of the blessings of the toothbrush, rampant decay is frequently manifest within a few months after landing. Dental caries is comparatively rarely observed in the teeth of habitual tobacco chewers. Miller and others have demonstrated that tobacco juice possesses no antiseptic action. Its prophylactic effect, as far as the teeth are concerned, rests with the pharmacologic action of tobacco, i. e., its alkaloid, nicotine, is a powerful salivary stimulant.

In a recent communication *(Dental Cosmos,* 1913, p. 1081), Pickerill tentatively admits the importance of the quantity of salivary secretion. He states: "I would even suggest that caries of the teeth may be regarded as a symptom of failure of the nervous mechanism controlling salivary secretions to functionate normally." In the writer's opinion, the quantity of the secreted saliva is the sole factor which governs environmental phenomena concerning tooth decay.

The quantity and, to a less extent, the quality of saliva, on account of our present methods of preparing and selecting foodstuffs and the consequent insufficient mastication, are frequently inadequate to bring about a proper physiologic cleansing of the oral cavity. To assist nature, suitable mechanical and chemical means may be employed to overcome this deficiency. The mechanical cleansing of the mouth and teeth by means of the brush, powder, paste, toothpick, floss silk, etc., constitutes the absolute fundamental principle of artificial oral hygiene. Food remnants and slimy adhesions between and upon the teeth, together with a large number of the adherent bacteria, are principally removed by mechanical cleansing. The mechanical cleansing of the oral cavity by these enumerated means may, however, be materially assisted by the judicious use of suitable mild astringent and indifferent antiseptic solutions. Powders, pastes, and washes containing soluble drugs, or drugs in solution, are employed for the avowed purposes of assisting nature in accomplishing the desired means to an end, i. e., they must favor the recovery of an inflamed mucous membrane, and they must mechanically remove accumulated food debris.

A good oral preparation should possess the following properties:

(1) It must be absolutely indifferent in regard to:

(a) The mucous membrane—noncaustic.

(b) The teeth—nondecalcifying (mechanical or chemical).

(c) The organism as a whole—nonpoisonous.

(2) It must not interfere with the normal physiologic cleansing of that oral cavity; i. e.,

(a) It must not inhibit the secretion of saliva;

(b) It must not perceptibly alter the reaction of saliva;

(c) It must not destroy the ferments of saliva.

(3) It must possess sufficient cleansing action, combined with

(4) Good taste and odor.

These various enumerated properties are naturally rarely found in combination in a single oral preparation, and yet each one is of great importance.

Hygienic measures as applied to the oral cavity are practiced in proportion to the pleasant sensation which they call forth, hence, a mouth preparation which has a disgusting taste is ineffective because it will not be employed for any length of time by the laity. The great mass of the public will never be induced to practice oral hygiene that involves ill-tasting preparations. As stated above, mouth preparations must be absolutely free from danger so far as the mucous membrane, the teeth, and the organism as a whole is concerned. Hence, Roese's dictum should be indelibly fixed in the mind of every dental and medical practitioner: "The importance of oral antisepsis is not so great that we are justified in assuming the slightest risk." This statement can not be emphasized too strongly in view of the fact that numberless mouth washes and tooth preparations of questionable character are continuously forced on the market. Unless the correct composition of a ready-made mouth or tooth preparation is known, it should not be recommended.

The majority of the so-called dental preparations which are employed by the laity for daily use belong to a group of medicinal compounds generically known as proprietary preparations. As these compounds are not used for the avowed purpose of curing a specific disease, but rather as hygienic measures, no objection can be raised from an ethical point of view, provided that they are prepared from approved formulæ and that they conform to the claims as outlined above.

A few of the more widely advertised preparations which are apparently universally recommended by the profession deserve special notice. Bad taste and general unfitness for the purpose in view are the lesser evils of most of these preparations; some are distinctly dangerous to the oral tissues when employed for daily use. The conception that mouth washes, tooth powders, and pastes which, in general, are nonpoisonous and neutral in reaction are indifferent to the oral tissues is erroneous. Many of these highly extolled compounds sail under dubious flags. For instance, an alkaline thymolated glycerine solution is claimed to possess extraordinary qualities as an oral antiseptic, while, in reality, it is about equally effective as a physiologic salt solution, but with a less pleasant taste. A 50 per cent potassium chlorate tooth paste at one time furnished "Nature's antiseptic—free oxygen—which whitens the teeth," and, while at present it cures "acid mouth," no trace of free oxygen was ever obtained from the use of this paste. The distinctive danger of potassium chlorate to the general health is, of course, not mentioned. Again, a mentholated salol solution is much lauded as "the most persistent oral antiseptic." This compound is rather prone to produce persistent eczematous eruptions about the corners of the mouth. Most of the widely advertised tooth powders, pastes, and certain mouth washes contain too high percentages of soap. Soap, on account of its alkalinity, invariably kills the important salivary ferments. The list of ill-constructed mouth preparations may be extended *ad libitum*. In spite of the absurd claims made by the manufacturers, it seems incomprehensible that numerous practitioners recommend such compounds to their patients. The best service that a conscientious practitioner

can render to his clientele is to absolutely prohibit the use of a mouth preparation of whose innocuousness he is not fully convinced.

The search for so-called tartar solvents as an addition to tooth preparations—substances which prevent or dissolve calcareous deposits about the teeth—has occupied the minds of the dental hygienists for some time past. The chemical nature of the oral calculus indicates that the logical solvent should be an acid or an acid salt. For plausible reasons, such substances can not be utilized in the mouth with impunity. It is known, however, that certain alkalies—the salines—prevent the ready formation of calculi, and they help to remove fresh deposits when brought in intimate contact therewith. Just how much of this destruction or removal should be attributed to the mechanical scrubbing of the brush, and how much to the solvent action of the ingredients of the tooth powder or paste, is not known at present. Nevertheless, the salts of certain mineral springs, especially those of Carlsbad, are used in concentrated form for such purposes, and apparently with some success. Artificial Carlsbad salts may be incorporated into a paste with calcium carbonate and other abrasives; its only drawback is its disagreeable salty taste. Tooth pastes containing about 25 per cent Carlsbad salt may be obtained in the market.

Innumerable experiments have been made to determine the so-called antiseptic strength of oral preparations. As a standard, the Rideal-Walker phenol coefficient or some other laboratory standard is usually employed as a means of arriving at some tangible conclusions. If these experiments are carried out in test tubes with cultures of isolated organisms, comparative deductions drawn from such tests are wholly unwarranted as they do not portray actual conditions existing in the oral cavity because the very premises upon which these experiments are based are erroneously chosen. On the other hand, if these preparations are tested directly in the mouths of normal individuals, it is invariably found that, in average, only 50 per cent of the oral bacterial flora is inhibited. Authorities agree that it is impossible to render the oral cavity sterile, even for a short period only, with any of the so far known antiseptic solutions (pastes, powders, etc., must enter into solution if any antiseptic effect is to be expected) in the strength in which these solutions can be employed with safety. The dilution of these preparations and the short time allowed for their action in the oral cavity as actually employed by the user, necessarily minimizes their antiseptic effect to such an extent as to practically render the solutions inert.

Recently, Gies has advocated diluted vinegar, and Pickerill, a solution of acid potassium tartrate as being most efficacious mouth washes. Both recommendations are based on observations made in the laboratory; their correctness is not substantiated by clinical evidence. The recommendation of an acid mouth wash of the above type is based on wrong premises because, first, the laity will not be induced to employ an ill-tasting mouth wash for any length of time, and, second, the pharmacologic principle evolved in the selection of such solutions is erroneously applied. When an acid mouth wash in the form of vinegar or acid potassium tartrate is taken in the mouth, a temporary copious flow of alkaline saliva, rich in mucin, is produced. This alkaline saliva serves as a diluent and neutralizer of the acid and the colloidal mucin acts as a protector of the

insulted mucous membrane and the teeth—Nature's method of getting rid of the irritant. In accordance with Heidenhain's law, forcible stimulation of salivary glands is followed by impairment of their function. Incidentally, the acidity of these solutions kills the important salivary ferments. It has been repeatedly shown, that a physiologic salt solution (approximately one dram of sodium chloride to a pint of boiled water) heated to a body temperature, reduces the oral flora by 50 per cent and, incidentally, it is absolutely safe. On the other hand clinical evidence seems to point to the beneficial effects which are obtained by the use of such milked alkaline astringents as well diluted lime water. E. Kells, Jr., Kirk, and many other observers have repeatedly called attention to the remarkably good results obtained by its continuous use. Its therapeutic effect depends on its solvent power of the mucin deposits on and about the teeth, which mechanically retain food debris and bacteria and on the formation of insoluble soaps with fatty acids and lipoid substances. Incidentally, the freshly precipitated calcium carbonate may possibly exert some mechanical protective influences on the teeth themselves. When employed in proper dilutions, its mild astringent effect favors the recovery of inflamed mucous surfaces which, to a mild degree, are almost universally present in the mouths of most persons. A tablespoonful (one-half ounce) of lime water added to a tumblerful (eight ounces) of physiologic salt solution makes a most serviceable mixture which may be used as a mouth wash with impunity. Incidentally, this solution corresponds more closely to an artificial saliva—Nature's protector of the teeth, than any other mouth wash found in the market.

I have made innumerable tests with the various dental preparations as found in the market and with experimental mixtures, by plating out specific quantities used within specific times in the oral cavity and counting the number of colonies before and after these tests. These experiments merely verify what has been stated above, namely:

1. Sterilization of the oral cavity with any of the commercial dental preparations or any antiseptic, in the strength in which it can be employed with safety, can not be accomplished.

2. The cleansing of the oral cavity with an antiseptic solution alone or combined with the mechanical effects of the toothbrush, powder, or paste, reduces the number of oral bacteria approximately about 50 per cent. The claims made for the antiseptic strength of certain commercial preparations are, by actual tests, wholly unwarranted.

3. A physiologic salt solution of body temperature in conjunction with the toothbrush and precipitated calcium carbonate in the form of a powder or a paste (providing these preparations are in conformity with the claims as outlined above) is the safest and most efficient of all so far known, artificial, oral hygienic measures.

CONSTITUTIONAL DISEASES IN INFANCY AND DENTITION*

By G. Lippmann, M.D., St. Louis, Mo.

I DEEM it a great privilege to appear before you today as a representative of a specialty that is, like yours, deeply concerned with the welfare of the young. It is only a short time since we have learned to realize the necessity of the different interests in medicine meeting together, a neglect not only detrimental to the followers of the profession, but also to suffering mankind. Those combined meetings must of necessity develop the curative side, as well as the preventative, of our science.

You all know what has been done in a prophylactic way in the prevention of infant mortality, a result, that was only made possible, by putting the feeding of the very young infant on a scientific basis. But to keep infants alive could not for a long time be the only aim of the new science of pediatrics. Its aim had to become the rearing of *healthy* human beings.

The close interrelation between the process of dentition and the health of the child, between mastication and growth, has not received sufficient consideration. We have only a short time ago rescued this absolutely normal physiologic process of cutting teeth from a mire of superstition. What innumerable symptoms were not ascribed to this act! We know today that this has little or no effect on the well-being of the infant; but now since we are fully convinced of the harmlessness of the process of the appearance of the teeth, we have learned more and more to recognize the importance that is attached to the preservation of healthy instruments of mastication and of their normal juxtaposition and contraposition.

To know how to prevent the now so prevalent dental caries and malocclusion demands that we look carefully into the scientific cause of these pathologic conditions. The fact can not be too strongly emphasized that there is no evidence that will bear scientific investigation that the teeth of this age are congenitally not as strong, or, better said, as normal, as those of our forefathers. The prevalence of dental disorders must, therefore, be looked for, not in a change of the character of the teeth themselves, but in the malign influences to which they are subjected. Fortunately the indestructibility of these tissues enables us to compare them with those of our ancestors.

We find that only a few generations ago dental caries was almost nonexistent or at least rare, while during the last fifty years caries and pyorrhea have become so prevalent that a good set of teeth is looked upon as marvelous. We know that among the Maoris of New Zealand, so long as they existed on native diet, caries was found only in one per cent; but after seventy years of more or less civilization, this condition occurs in about ninety-five per cent of Maori children. Living under European influence produced a change which coincides with that prevalent under the full influence of modern western environment.

*Read before the Seventeenth Annual Meeting of the American Society of Orthodontists, Excelsior Springs, Mo., Sept. 6, 1917.

This ought to and really does give us a perfect clue to the right direction which we must follow in the rearing of normal children. The child has the undisputable right to demand feeding from the mother. Cows' milk is the food for calves; human milk for human beings. But this is not the only point to be considered; we must appreciate the fact that the act of taking nourishment from the breast differs from that of sucking from a rubber nipple. The emptying of the mammary gland calls for an increased muscular activity on the part of the infant, so that the alveolar arches become more fully developed. The high roofed palate and narrow arch is of rare occurrence in children that are breast fed for the first eight or ten months of life. The quality of the teeth also depends on the supply of natural food. The teeth of breast-fed children are much better calcified than the teeth of children reared on cows' milk. So marked is the difference in the structure of the teeth that we can pick the child that has been breast-fed. At the age of eight to ten months the time of weaning has arrived and contemporaneously the incisors appear. These implements of gnawing surely have a purpose. Is milk still to be the only means of sustenance to be given to this child? Most assuredly not. What is the usual diet ordered now? We prescribe a mixture of milk with mush or toast, sweetened, soup, mashed potatoes, and vegetables run through a collender. Is that the diet aborigines give to their children? The infant, when teething, likes to bite on something hard; by instinct, he tries to get nourishment from a hard substance. Milk, of course, must be given to the child, but the carbohydrates should be supplied in the form of hard toast or stale bread. Later on, when the molars have made their appearance, a food should be given that necessitates grinding and milling.

If only a finely divided food is offered, the child will bolt its food and will grumble if it has to chew. It is hardly necessary to mention here in condemnatory terms the deleterious custom of giving soft sweetmeat at the end of the meal. The meal should be concluded by the chewing of a piece of hard toast and, if possible, followed by fresh fruit, especially a slice of orange. This enforced mastication will not only do more in the prevention of caries than the most careful use of the toothbrush, but will show its good effects in another direction. The biting on hard substances must of necessity promote the development of the jaws and must produce larger arches for the teeth. With a better arch the high roofed palate can not occur so frequently. While this would undoubtedly permit a freer passage of air through the anterior nares, a full working of the muscles of mastication, owing to their attachment, would also tend strongly to widen the posterior openings of these parts. The distinct tendency to an inadequacy of the nasal passages might be overcome by a rational method of infant feeding.

It has been remarked before that almost any infant reared on cows' milk shows the consequences of it in susceptibility to dental caries. We pediatricians recognize three classes of infants in relation to cows' milk feeding. A comparatively small number of infants *can not* be reared on cows' milk *at all*. The second type *can* be reared on cows' milk, and the third *may be* reared on this food only with great difficulty. Let me assure you that if the last class were a very numerous one, the graveyards would not be filled with the corpses of the very young.

The frequent disturbances in the growth of the child caused by the unnatural character of the food accounts for the retardation of bone and tooth formation and a decrease in their resistance.

Furthermore, we should mention two important congenital dispositions to disorder or disease; first, the rachitic diathesis, and, secondly, the exudative diathesis. Both play a very important role in producing dental disturbances, caries as well as malocclusion. I do not intend to go deeply into the pathology of rickets, but will simply mention the fact that in rickets the young bone tissue does not calcify sufficiently or sometimes not at all. Bones that were fully developed lose their lime salts during the course of the disease. Dentition is of necessity strongly influenced. The first teeth do not begin to appear at the regular, expected time; a delay occurs that sometimes puts the appearance of the first tooth off to the beginning of the third year. The interval between the cutting of the teeth is prolonged. Dentition may come in the most irregular way. The incisors of the upper jaw are usually very small, soft, and friable. They show a greenish discoloration and are almost always susceptible to caries, a caries that sometimes completely amputates the tooth. The formation of tartar is excessive. The temporary teeth are frequently eroded around the neck and roots, while the permanent teeth, already damaged before their appearance, show also erosions on the body and the cutting edge. Of especial interest to the orthodontist are the malformations caused in the jaws by this disease. The lower jaw is shortened in the sagital direction, causing what is technically called the trapeze form of the lower jaw. The upper jaw is lengthened in the frontal direction, producing a lyra form. The lower alveolar processes show a tendency to turn in; the upper alveolar processes, a tendency to turn out; thus creating the picture of malocclusion so well known to all.

This is the picture of the damage done by this disease in so far as it is of especial interest to the followers of the dental science. Of the harm caused to osseous system in general, and of its destructive influence on the child as a whole, I do not want to discourse here; suffice it to say that it is absolutely necessary to be able to diagnose rickets in its very beginning, before permanent malformations occur. The symptomatology of early rickets is as follows:

A child that has always been lively shows less vigor and cries easily. It buries its head into the mattress or pillow and moves it from side to side until the occiput becomes bald. During sleep it perspires so freely around the head that the pillow shows the mark of the perspiration. Characteristic of this sweat is its stickiness and its peculiar sour odor. While these early symptoms prevail, no change on the osseous system has taken place, they only occur weeks afterwards. The time for interference is clearly indicated, and while we are not in possession of the absolute knowledge of the pathogenesis of the disease, while one theory chases the other as to the cause of rickets, we are well able to deal with it in a curative manner. Fresh air, massage, exercises, and baths are indicated to improve the general condition. This combined with the internal use of phosphor codliver oil is an absolutely sure way to overcome this malady and prevent all its consequences.

Let us now see to what extent the other diathesis, the exudative diathesis,

should be of interest to you. The exudative diathesis derives its name from the tendency of the patient to exude easily from the skin and the mucous membrane. The primary disturbances of the skin consist in the appearance of brownish black, adherent spots on the hairy part of the scalp. The skin of the cheeks is reddened and thickened. Behind the ears we may find an intertrigo, an oozing skinfold, very resistant to treatment. The tongue shows the characteristic picture of the so-called geographical tongue, which is produced by exudations on its surface with an increased prominence of the papillæ, the white spots being caused by a peeling off of the epithelium. Of greater importance than those changes occurring on the outer skin, are those connected with the upper air passages. The tonsils and adenoids are enlarged. It would be carrying coals to Newcastle, were I, as a physician, to speak to you of the influence of mouth-breathing on the correct occlusion of the teeth. Here as in rickets we are in darkness as to its pathogenesis, but we do know how to prevent this symptom-complex from doing permanent injury to the young infant. The cure rests solely on the diet prescribed. The regime must be so arranged that an accumulation of adipose tissue on the part of the child is prevented. The weight of the patient must be kept in certain limits, without, of course, weakening him.

I can not conclude these short remarks without mentioning one more specific pathologic entity that exerts at times a pronounced influence on the teeth, and that is syphilis. With a disease so fully known to science as lues, and with the profession in the possession of a cure, if there be a cure in medicine, there is hardly any excuse for its harmful after-effects. In speaking of the teeth in connection with this disease, we have to mention here the name of the famous English clinician, Hutchinson, who first carefully studied and described the changes produced by syphilis on the teeth. Let me advise you to follow his careful description closely. "The upper middle incisors show on their cutting edge a half-moon-like concave tissue loss, and frequently, though not always, the dentin becomes visible. The teeth are barrel-shaped." I mention this classical description here because only too frequently the diagnosis of lues is made by mistaking the inroads made by rickets for those made by syphilis.

CONCLUSIONS

1. Dental caries, being a disease of civilization, does not rest on congenital lack of resistance. The cause must be looked for in injudicious feeding.

2. The rachitic and exudative diatheses must be counted among the causative agents of dental malocclusion and caries.

3. The influence of syphilis on the teeth is of comparatively minor importance.

DISCUSSION ON THE PAPERS OF DR. PRINZ AND DR. LIPPMANN

Dr. Prinz.—Dr. Lippmann has set forth the causes which are predisposing to dental caries. There is no question in my mind and apparently in his mind that the sole factor of a boy's health, so far as the teeth themselves are concerned, is the underlying factor in regard to the so-called predisposition of these particular teeth to decay. Remember, there is one important fact, that the teeth, as such, have no bearing upon the anatomy as a whole. Decay of the teeth is not a disease in the true sense of the word, as we understand it, and from a general biologic point of view. A tooth, whether it is taken as a whole or removed, attached to a rubber plate as an artificial substitute in this particular mouth, will always decay. It decays from its predisposition. Therefore, internal medication for the purpose of overcoming or limiting so-called predisposition to caries is wrong. It has no bearing on the subject whatsoever. It is solely a question of diet. Naturally the protection of the oral cavity depends upon the quantity of saliva, and the quantity of saliva, as Dr. Lippmann has shown distinctly, depends upon the physiologic processes of mastication. Saliva, as such, from the viewpoint of the biologist is not a question of alkaline or acid fluid which preserves or destroys the teeth. The quantity of saliva produced and its chemical reaction are due to the fact that the nutrition which we put inside of our patients calls for that specific reaction that we find. Certain foodstuffs do not call for the production of saliva at all. To reestablish, for instance, an artificial salivary fistula, we feed an animal such things as milk, and no increase of saliva occurs. On the other hand, if you put into its mouth any substance which is boiling, as, for instance, ripe meat, it has profuse flow of saliva.

It is stated and frequently quoted in dental circles that the dog usually does not suffer from dental caries; he suffers from pyorrhea and loss of teeth, but dental caries are comparatively rarely met with. Please understand that a dog in his make-up is totally different from the human being. He is primarily a carnivorous animal; he swallows his food. If we make an analysis of the saliva of the dog we do not find ptyalin, and some men say that ptyalin is what controls saliva. If we take a domestic dog and feed him for a week on pure carbohydrates, we find that we can produce ptyalin and amylase; that the gland which produces saliva has adapted itself to conditions. It is said there are certain kinds of decay where we meet with so-called immunity, and then again we meet with a pronounced predisposition to decay during the life cycle. We can always trace an apparent immunity or an apparent predisposition or disturbed immunity to glandular changes, to inactivity of the glands. I have mentioned the fact that in prolonged cases of typhoid fever, we find a predisposition to decay of the teeth simply because we have incidentally glandular impairment. In the peculiar disease known as osteomalacia the teeth melt away like snow before the sun because there is no flow of saliva. Saliva primarily protects the bony structure of the oral cavity which we refer to as the teeth. A free flow of saliva is the sequence of powerful normal mastication.

Dr. Lippmann has referred to the teeth of Maori children. He said that in a normal state there was not more than one per cent of decay, but living under civilized conditions pronounced decay of the teeth has taken place as is manifestly shown. This is not due to the fact that there is a difference in the make-up of the tooth structure, but it is due to the fact that the Maori child is fed on things which are contrary to its nature, contrary to what nature intended, and we find also in animals kept in captivity pronounced and distinct liability to dental caries because they live under conditions where they do not have to fight for their food. That is an important factor.

As to the therapeutic value of dental preparations, I have nothing more to say than what I have already said.

Dr. B. E. Lischer.—I am frank to confess that I am unable to discuss these two able papers as I should like to discuss them, but I believe I express the sentiments of every member present when I say to the essayists that we are very thankful to you for your contributions to our program and your participation in our meeting.

I merely wish to emphasize the fact that Dr. Prinz concludes that a solution of sodium chloride and a harmless powder which will act as a mechanical cleanser are, after all, the best agents for daily use by the patient. And since he has presented his arguments so thoroughly, I feel that his seemingly simple conclusions represent considerable value and progress.

Most of the children that come to us for the treatment of their oral deformities are,

as a rule, in a state of health. But we frequently meet with cases that do not respond to treatment as readily as we expect. Now, I would like to ask Dr. Lippmann if some of these patients suffer, to a greater or less extent, from some of the conditions he has outlined for us today. In other words, is has often seemed to me that some of our patients ought to be under the care of a physician for the correction of some underlying condition; be that rickets, the exudative diathesis, or congenital lues.

Dr. Sullivan.—I would like to hear some remarks from Dr. Lippmann on the influence of tuberculosis and kindred diseases on dentition.

Dr. B. W. Weinberger.—I appreciate the paper of Dr. Prinz and especially the one presented by Dr. Lippmann. It only bears out some of the contentions I tried to bring before you yesterday, and among them, that there is such a thing as I pointed out in my paper expressed in general conditions. Most of the skulls which were shown were of a rachitic nature.

There is one point I am sorry Dr. Lippmann did not touch upon, namely, the influence of the effects of internal secretions on the development of the tooth, dentition, and so on. That is a question we have to consider immediately. It is the one question that is causing all sorts of trouble. We hardly realize it. We are only beginning to find out here and there a few points that show conclusively that it is one step that we have to investigate. Naturally these conditions are met by men who are intimately in contact with them, and it is up to them more than it is to men engaged in our profession to help us along in this way.

I would like to ask Dr. Lippmann what he has found with regard to the internal secretions, outside of the rachitic condition, how congenital these cases are, and the possibility of these conditions being present at birth, preventing the proper nourishment of the children, due to the extreme distal and posterior relations of the mandible. If he has had any experience with any of these cases, I am sure we would all like to hear it.

Dr. G. Lippmann.—The question asked by Dr. Lischer I will answer later when I take up the questions of Dr. Weinberger.

One gentleman (Dr. Sullivan) inquired as to the influence of tuberculosis and kindred diseases on dentition. Dr. Prinz has answered that in speaking of typhoid fever. Whenever you have a lowering of the pulse tension you surely have a reason for the development of dental caries or dental destruction.

Reference was made to a faulty condition of the osseous system in children with rickets, and also to stories told by the mothers. To make a diagnosis of rickets in after life, it is necessary to ask three questions. First: Do you remember whether the baby perspired around the head when it slept? The mother does not think anything of that. She answers yes. Second: At what age did the baby begin to walk? Third: When did dentition actually occur? What teeth came in first? In what rotation did the teeth appear? If you can get these three questions answered, you can make a diagnosis of rickets in after life. The harm done to the osseous system is shown by the knock-kneedness and bow-leggedness of the child and by the peculiar formation of the head, the brow of Jupiter, the protruding frontal bones, and a somewhat flat upper appearance of the skull will tell you that the child has rickets. Of coarse, rickets appears early enough in life not to do any permanent harm if it is cured. The harm done by rickets is not only done by the first teeth, but done to the permanent teeth, so that caries is one thing that occurs in the second teeth in the rickety human being, and also the malformations I spoke of, a tilting of the upper arch and a tilting of the lower arch.

We do not know the cause of rickets.

As to the question of breast-fed children. Almost all mothers can feed their babies at the breast if they are handled correctly. There is no guaranty that milk must come in three days or ten days, but the milk will come if the mother is persistent. There is no difference in the quality of milk of the mother.

Dr. Prinz spoke of the use of certain therapeutic preparations and about chemical analysis. You can not make a chemical analysis of milk percentage in the breast of a human being, because you can not empty the mammary glands. Every farmer will tell you that the first stripping of the milk looks blue. That is always the case. The last part that is taken away from the mammary glands is the cream, so that when the doctor speaks of having a chemical analysis made of the milk you know right away it can not be done. In the first place, much depends upon the milker of the mammary glands. The mammary gland can not be emptied artificially. In the second place, it is not clear that it is the chemical quality of the milk that makes a difference in the feeding of the child. We have gone to the period of percentage feeding in trying to make cows' milk equal to human milk

by percentage. We find we have not touched the physiologic principle of it, besides the salt principle in the two milks. Breast-feeding can be instituted in almost every case, and the child that is not breast-fed is handicapped.

Let us now take up the question of rickets in relation to the internal secretions. We today, as I said in my paper, do not know any reason for rickets, yet it is a peculiar condition. In England, where the milk is poor, rickets is produced by lack of fat in foods. On the continent, where the milk is fairly rich, rickets is produced by too much carbohydrates. In America, where we have raw milk, it is produced by boiling the milk or by artificial foods. This symptom-complex I called a diathesis; I did not call it a disease. It is a symptom-complex we do not know, but it may be produced by congenital disturbances of the internal secretion, and especially the secretion of the adrenal bodies and parathyroid gland. Let us go a little deeper into that, as possibly it may be interesting. I would like to say that those men engaged in your line of work in looking for congenital malocclusions and other pathologic conditions are not satisfied with taking pictures of the skull only. The question arises: Is rickets a congenital predisposition, an exudative diathesis produced by imperfect secretion of the adrenals and parathyroid bodies? We must take a picture of the long bones together with the head in order to make a diagnosis.

In rickets children who have gastric disturbance will suddenly develop spasms, or they will develop a spasm of the larynx that is accompanied by a crowing sound. The child gets blue in the face. These children are susceptible to spasms, they are rickety in all probability, and the spasm is produced by a disturbance in the parathyroid bodies and by a disturbance in the calcium metabolism. If the calcium metabolism is disturbed, and there is a disturbance in the adrenals and parathyroid bodies, we can see why the teeth should be disturbed by rickets. Besides giving phosphorus for combining the calcium, we can see why we should get results in these cases if we give children adrenalin internally and extract of the parathyroid bodies. Besides, if children susceptible to spasms are given repeated doses, they will not get a second spasm if fed calcium chloride or calcium lactate. This may give you an idea of how to overcome the ravages of early disturbed metabolism by feeding any one of the calcium salts.

Another interesting question comes up here about the internal secretion, and that is a question of abnormal position of the teeth in an abnormal mandible, especially with widening intervals between the teeth and with small teeth at the same time. I have put these cases down as low myxedematous cases, where there is a lack of thyroid and these cases improve under thyroid treatment. I did not quite understand Dr. Lischer's question.

Dr. Lischer.—May not some of these children go to the orthodontist without being under the care of a physician?

Dr. Lippmann.—In the first place, it is important to make a diagnosis of late rickets, which is not so rare as you think; second, the diagnosis of very light cases of myxedema; third, those cases that are still suffering from injudicious feeding at an older age. If you get results in your cases of malocclusion, you are fairly safe in giving small doses of thyroids to help the normal position of the teeth and normal growth with calcium metabolism. These old cases of rickets improve under thyroid, adrenalin, or calcium chloride treatment

The question of feeding is a hobby of mine. Feeding in infancy has to do with the weaning period. In nature sugar never appears as such except on two occasions, and that is honey, and in the sugar cane. Honey, of course, is not meant for food to any great extent. A child would have to chew pretty hard on sugar cane to get a small quantity of sugar, and in getting sugar would at least get sufficient saliva to wash the sugar down. In all our feeding we prescribe that a three-year-old child has to chew scraped beef, soft boiled eggs, mashed potatoes, vegetables, and so on. In addition, it receives gruel, porridge, nothing to eat. and the worst habit of all, besides not chewing, the child gets at the end of a meal a piece of soft candy so that it may not get hurt.

Dr. Prinz mentioned food. I spoke about Swedish bread. Most of the bread is whole rye bread and if toasted besides, it is a splendid means of overcoming the end of the meal.

Dr. Federspiel.—I am sure the Society appreciates the kindness of Dr. Prinz and Dr. Lippmann for presenting these two splendid papers. If we keep good records particularly of the teeth and take into consideration the systemic conditions and cooperate with the internists, we will accomplish more in the future than we have done in the past.

THE TEETH IN SORCERY AND MAGIC*

By Charles Channing Allen, D.D.S., Kansas City, Mo.

Professor of Operative Dentistry in the Kansas City Dental College.

FEW dentists have ever thought about or given consideration to the large place the teeth occupy in magic, sorcery, and folklore, to say nothing of a goodly mention they obtain in general literature. Since the earliest times and among all primitive races, teeth, especially human teeth, have occupied an important place in magic ceremonies, sorcery, incantations, the practice of magic, and the working of charms. The tribal magician, or medicine man, as he is better known in North America, would suffer considerable loss if he were denied the use of teeth in his practices. There is a new and particularly rich field to be explored by one who will interest himself or is interested in the curious historical toothlore which exists and is constantly being added to relating to primitive, savage, and barbarous peoples; nor are these apparently foolish and useless practices confined wholly to the primitive and barbarous peoples. We find remnants of magic practices existing much more generally than supposed among people of the highest civilization of which we boast and those people of the greatest culture. Nearly everyone is constantly in his daily acts doing little things as charms or wards of evil or exorations for luck who would scorn the implication that he was working the Black Art. Yet the same man feels a little elation, perhaps, and a sense of sublimnal satisfaction if he sees the new moon over his right shoulder. These lingering superstitions, which are dimly outlined, but no less indelibly fixed in almost every mind, are the remnants of the ancient tribal beliefs and ceremonies of our savage ancestors. They are mental survivals, long grown useless, which correspond to such physical survivals as the muscles in the ear, the appendix, the third molars, and others which persist to plague or puzzle humanity. Nor can it be said that culture or intellectuality frees one entirely from this form of mysterious influence, and among the more ignorant of our own citizenship, which is supposed to be the most enlightened in the world, they often amount to a baleful slavery. Long lists could be made of the personal superstitions of great men. Nearly every statesman, poet, philosopher, or scientist has in some small way, paid tribute to the long forgotten ceremonies, incantations, and beliefs of the Magi. We are no less the unconscious votaries of Black Art. Many is the farmer who carefully considers the phase of the moon when planting his crops. It would be an almost interminable task to catalogue the superstitions common to the daily lives of peoples of all lands and races. But we may refer to a few with which we are all familiar.

When you awake in the morning, you are apprehensive if you have dreamed about snakes or a dozen other things which are ominous. You are careful to put your right shoe on first, and if you sing before breakfast you cry before

*Read before the Seventeenth Annual Meeting of the American Society of Orthodontists, Excelsior Springs, Mo., Sept. 5, 1917.

night. If you accidentally spill salt at the table, you quickly throw a pinch over your shoulder. If you take an umbrella from the rack and start to raise it in the house, there is a domestic tumult. Having left the house, if you should return for a forgotten article, you must sit down and count ten or your day will not be fortuitous. If a black cat runs across your path it is a sure sign of bad luck; and if you shudder, you know someone has walked over your grave, notwithstanding the fact that you are not yet a tenant of the narrow cell. If you meet a cross-eyed person, you must find a four leaf clover or some other talisman to remove the hoodoo. When you pay your car fare, you must be careful not to lose the buckeye you are carrying for your rheumatism or spend your lucky piece, to say nothing of the potato you used to carry before the lowly spud ranked as a gem. When you look at your time piece you toy for a moment with the rabbit's foot that adorns your watch chain. If you open your morning paper and should note that it is Friday, the thirteenth, you would certainly refrain from any new business adventure that day. If, when you step from the street car, you notice a three-pound horeshoe in the street, you will, of course, pick it up and lug it around all day. If there is a ladder leaning against the side of a building you are careful to walk around it. If there happens to be a hunchback in the elevator as you mount to your office, you will, of course, be careful to surreptitiously touch the hump. If an office friend gives you a knife or an ivory-handled paper cutter, you hand him a penny because the instrument is sharp and you must purchase it to avoid cutting friendship. Before going home in the afternoon you purchase an emerald for your wife because an opal is unlucky. When you step from the car and see the new moon over your right shoulder, you make a wish and turn over the silver in your pocket. Later you retire to sleep and let us hope to lucky dreams.

These are only a few of the superstitions that beset your daily routine. In all this we have made no reference to the teeth, yet, in the original causes of all these superstitions and customs, we find the teeth have played an important part.

Knocking out of certain teeth is practiced as a principal ceremony of initiation among certain eastern Australian tribes. It is also practiced by central tribes of the lonely continent, although not as an initiation rite. The hypothesis upon which they proceed is that, being a vital part of a man, a tooth sacrificed will help insure to him another life after death, and it is supposed that a tooth is chosen because of its well known durability compared with the corruptibility of other portions of the body. The extracted tooth is believed to remain in sympathetic connection with the man from whom it is removed. These extracted teeth were carefully cared for lest the former owner fall ill. With some tribes the mother of the lad initiated, according to custom, chose a young gum tree and inserted her son's teeth in the bark at the fork of the two utmost boughs. This tree was afterwards held sacred, and was made known only to certain persons of the tribe; but the youth himself was never permitted to know where the tree was. If the boy died, the tree was killed by fire. Other tribes would throw the teeth as far as possible in the direction the mother was supposed to have once camped. It was the custom of another Australian tribe to bury the teeth by the side of a pool for the purpose of stopping rain. When the teeth were

inserted in a bark of a tree near a river, or water hole, if the bark grew over the tooth or if the tooth fell into the water, all was well; but, if the ants ran over it, the boy would suffer from a disease of the mouth. This is very clearly the origin of pyorrhea, which has been so long and laboriously searched for by our prominent bacteriologists!

Among the Murrang and other tribes of New South Wales, the extracted tooth was first taken by an old man and passed from one head-man to another, until finally it was returned to the boy's father and then to the lad himself. But in this journey it must on no account be placed in a bag containing other magic substances for that would endanger the young man. A man of the Murrang tribe traveled two hundred and fifty miles to fetch back some teeth because one of the boys, to whom they had belonged, had fallen into ill health, and the old man believed some injury had befallen the teeth. At other times the boy's father, or next of kin, would carefully bind up the teeth in emu feathers until after the mouth had healed. After this the teeth were treated in a magic manner in order to take the supposed life out of them. This interesting process consisted in the man making a low, rumbling noise without uttering any words, blowing two or three times with his mouth and jerking the teeth through his hand to some little distance. The teeth were then buried about eighteen inches under ground. Failure to do this would have made the boy liable to an ulcerated and wry mouth and ultimately to a distorted face.

For some curious reasons the Central Australian tribes generally associated the extraction of teeth with rain and water. In the Warramunga tribe they generally knocked out the teeth about the end of the wet season when they did not wish any more rain. The ceremony always took place on the banks of a water hole. When the natives of the York Peninsula in Queensland are preparing to knock out the young man's tooth, they mention the various districts which the relatives or parents of the young man have owned or frequented, and the name which is uttered at the instant the tooth flies out, is the country to which the lad is accredited as a citizen. This is an easy method of determining citizenship which sometimes might be used to advantage nowadays. Further, when the young man spits the blood out on the ground, the old men examine it to find trace of a likeness to some animal or plant, and the fancied likeness determines this man's totem.

A certain African tribe seems to be especially subject to lockjaw, and, in order to combat this distressing disease, they resort to a rather heroic preparedness by knocking out some of the teeth. The Malaysia think only people with good even teeth should plant maize, otherwise there will be empty spaces on the cob. Tribes in eastern Peru think that to carry the poison tooth of a serpent is a protection against the bite of a serpent, and their infallible remedy against toothache is to rub the face with the tooth. Some Brazilian Indians hang the teeth of an animal, called the grass-eater, around a girl's neck at puberty. What particular purpose that answers does not appear.

The ancient Greeks used to think they could dye their hair black with ravens' eggs; but while they were doing this, it was necessary to keep the mouth full of oil, otherwise the teeth also would be dyed black. The Galelarees think

when the teeth are being filed, you should keep spitting on a pebble, for this establishes a magic connection between you and the pebble. Henceforth your teeth will be hard and durable as stone. They also believe you should not comb a child's hair before teething, otherwise the teeth will be separated from each other. The Basutos carefully conceal their extracted teeth to keep them out of the hands of mythical beings called Baloi. There beings haunt graves, and if they found the teeth, they could injure the owner by working magic upon them.

There are still people in rural England who will not throw away children's cast teeth, believing if they were found and gnawed by an animal, the children would have teeth like that animal. They proved this by citing cases of supposed resemblance of certain human teeth to animal teeth. Upon the same principle, in other parts of the world, teeth are placed where they will be found by rats or mice in order that the former owner may have the fine teeth of these rodents.

In Germany there is a maxim which bids you put your tooth in a mouse's hole. To do so with a deciduous tooth, prevents the child from having toothache. Or you should go behind the stove, throw your tooth backwards over your head and say, "Mousie, give me your iron tooth; I will give you my bone tooth." If we were all careful to follow this simple formula, it would be wholly unnecessary to bother our heads about professional advancement. The German children also say, "Mousie, mousie, come out and bring me a new tooth;" or, "Mousie, I give you a little bone, give me a little stone;" or, "Mousie, there is an old tooth for you, make me a new one." This ceremony is believed in Bavaria, to insure that the teeth will be as white as the teeth of mice. The southern Slavonian children throw their teeth in the corner and say, "Mousie, there is a bone tooth, give me an iron tooth."

The Jewish children in southern Russia throw their teeth in the thatch roof with the same request to the mousie. You will notice the similarity in Raratonga in the Pacific, where the child offers the following prayer, when the tooth is extracted:

"Big rat! Little rat!
Here's my old tooth.
Pray give me a new one."

Then the tooth is thrown on the thatch of the home because the rats make their nests there. The rats have the strongest teeth known to those natives. A very similar ceremony is observed in the Sarangalas and Gorong Archipeligos. In the Kei Islands to the southwest of New Guinea, the child is lifted to the roof in order that he may deposit the tooth himself, with a similar invocation to the rats, with this difference—he requests a golden tooth instead.

The same custom exists in Mexico where the father believes if the tooth is not put in the mouse's hole there will be no new one issue from the gums. A more barbarous application of the same principle is the Swabian superstition that you should bite off the head of a living mouse when the child is teething and hang the head around the child's neck by a string, being careful not to make a knot in the string. This will make the teething easy. A very simple procedure indeed, but the Bohemians have improved upon it. They recommend

the use of a red string with the heads of three mice instead of one. We have noticed the widespread fame of the rat and mouse as a producer of sound teeth, a fact which has heretofore been overlooked by the gentlemen of our profession.

There are other animals that can lay claim to a portion of this distinction. The Singhalese invokes the squirrel. Again, in parts of Bohemia, the fox is asked for an iron tooth instead of a bone one. In Berlin the teeth of a fox are worn as a necklace around the throat, and make teething easy, as well as insure good and lasting teeth. The children of Victoria fasten to their wrists the tooth of a kangaroo with which they are to rub the gum. The Cherokee Indians supplicate the beaver to put a new tooth in their jaw. In Macedonia the child keeps his cast tooth for a while, then throws it at the roof and invokes the crow. It would seem the crow was poorly equipped to supply teeth of any kind, yet he is addressed as follows:

"O dear crow, here is a tooth of bone,
Take it and give me a tooth of iron instead."

The Thompson Indians of British Columbia hide the cast teeth of their children in raw venison and give it to the dog to eat, with the idea doubtless that this insures children strong, fine teeth such as the dog had. Mothers of Silesia frequently swallow their children's teeth in order to insure them against toothache and perhaps strengthen the weak teeth of children by the strong teeth of the adult.

In Central Australia, when a girl's tooth is knocked out as a ceremony, it is pounded up, the fragments placed in a piece of meat, and eaten by the girl's mother. When the same rite has been performed for a man, the pounded tooth must be eaten by his mother-in-law. The Arab boy throws his tooth towards the sun and asks for a tooth smooth and white like a hailstone. The peasant people of Lebanon say to the sun, "Sun, sun, take an ass's tooth and give me a deer's tooth."

There are many and curious empirical methods of treating and curing toothache. A piece of mistletoe hung around the neck is used in some parts of England as a remedy for toothache. Sometimes a double hazelnut is carried in the pocket as a ward against toothache. Another old English custom in case of toothache was to puncture the gum with a nail, then drive the nail into one of the roof beams, or rafters. This treatment not only cured a toothache, but insured against its recurrence ever after. To secure yourself from toothache you will be told in Sussex to be careful always to put on the right stocking before the left, and to put the right leg into trousers before the left. In Lancashire charmed belts or a cord around the loins is worn to ward off toothache. In other localities, a tooth taken from the mouth of a corpse is often enveloped in a little bag, and worn around the neck to secure the wearer against toothache. St. Appollonia was the chief recognized healer of toothache despite the incessant mention of St. Peter. At her martyrdom in Alexandria, under the Emperor Philip, her teeth were beaten out. Her emblems are, "Holding a tooth in pinchers. Her teeth pulled out. Pinchers in left hand; tooth in right. Pinchers alone. Tied to a pillar and scourged." St. Lucy also divides honors as the

patron saint against toothache. Without the least suggestion of irreverance, we frequently find the name of our Savior connected with what might appear to be tribal and Apocryphal legends in connection with the cure of sickness. There are many legends of this kind extant. Sometimes the legends are difficult either to explain or trace. This may be well illustrated by the charm for toothache which is popular among certain English peasants. One version runs—

"Christ pass'd by His brother's door,
Saw His brother lying on the floor.
What ailest thee, brother?
Pain in the teeth?
Thy teeth shall pain thee no more."

According to Artemidorus, the loss of a right or left tooth presages the death of a male or female relative.

In Lancashire the following is frequently worn sewn inside the waistcoat or stays, and over the left breast: "As Sant Peter sat at the geats of Jerusalm our Blessed Lord and Saviour Jesus Christ passed by and sead, what elsth thee? Hee sead, Lord my teeth ecketh. Hee sead, arise and follow mee, and thy teeth shall never eake eney mour."

There are some references to the teeth in the Bible, "The fathers have eaten sour grapes and the children's teeth are set on edge," but there seem to be more in the Talmud, according to which the teeth of foxes have the power to cause or prevent sleep. The teeth of a live fox would prevent sleep; the teeth of a dead fox produced sleep.

For much of the material in this paper I am indebted to Dr. J. G. Frazer and W. G. Black, as well as the late Dr. John J. R. Patrick.

DISCUSSION

Dr. R. Ottolengui.—I am a little bit handicapped in not having had a copy of this paper in advance, because, while I am not a magician myself I have read a number of works on the subject of magic and recall having seen many remedies in them for toothache. I was particularly interested in that part of the paper in which we find that a child who loses his deciduous teeth appeals to a rat or a mouse for one that is better. I believe that we can manage many children through their imagination, which, indeed is a part of the science known as child psychology. I had a little girl patient recently for whom I wished to extract a temporary tooth; she objected strenuously, so I said to her, "The tooth is very loose and will not hurt and after it is out I will fold it up for you in a nice clean envelope and you take it home and when you go to sleep tonight put it under your pillow; then when you wake up in the morning look under the pillow the very first thing and in place of the tooth you will find a nice new dollar." This attracted her attention at once, but it also attracted the attention of her father who was present and he remarked, "You have that wrong, Doctor; in our house a tooth put under the pillow changes into a dime, not a dollar." This remark on the part of the father interfered somewhat with my application of child psychology. This matter of child psychology is quite important, and while I believe that the most successful practice must come almost by intuition, still there are some good works on the subject that it would pay many of us to read. I was very pleased this winter to know that the girls who are studying to be hygienists in a school in New York City have regular lectures on child psychology by a specialist in this science.

Dealing with children, a great deal can be accomplished by appealing to their sense of personal esteem. As an example, I had two children under my care this winter, a sister

and brother. The boy was the older and was very nervous and apprehensive; whereas the younger, the girl, was quite phlegmatic. Almost anything that I attempted to do for the boy would be met by the query, "Will it hurt?" So finally I asked him, "What does that word 'hurt' mean?" He said, "Why, you know." But I assured him quite seriously that I did not know the word at all and I asked him if he thought he could show it to me in the dictionary. He at once offered to do so. My office assistant brought out the dictionary and the boy looked for the word. When he came to the place where it should be, to his surprise he found that the word had been cut out, and he remarked, "Why it isn't here, somebody has cut it out!" and I answered, "Yes we cut that word out long ago from our dictionary because we have no use for it in this office." Not wishing to be entirely outone, the boy said, "I am going to look for 'pain,'" and immediately turned to the P's. Fortunately for me, however, that had been cut out also. Still this did not entirely change his attitude of fear towards me; so one day I said to him, "Son, I can not tell from the way children dress now-a-days whether they are boys or girls. I have to decide sometimes by the way people act, and from the way you behave I sometimes think you must be a girl." He asked, "Why?" and I said "Because little girls always complain about everything, but boys never do, because boys know that they are nothing but little men and men never complain." Next time he came in I said to him, "Mollie, don't do that." He retorted, "My name isn't Mollie, it's Bill," and I answered, "You don't act a bit like a boy named Bill, so I thought you were a girl." The second or third day on which I called him Mollie he turned to me with a half grin on his face and said, "Doctor, I get you; go ahead with your work." I really borrowed that idea from the mother of another boy who began to be fidgety in the chair when his mother said to him, "Charles, are you a man or a mouse?" He replied at once, "I am a man, mother," and then turning to me added, "But wait a minute, Doctor, did you ever do anything like this before to a little fellow like me?" and I answered, "I have done it to boys much smaller than you and also to girls." At once he replied, "Then you can go ahead." Thus we can make use of psychology and lead the minds of children away from the notion of pain, but it is very necessary that you keep all of your promises and never promise what can not possibly be performed. It has long ago been pointed out by a good psychologist that mental anticipation plays a large part in realization; that is to say, if a patient anticipates or expects to be hurt, the slightest unpleasant sensation becomes real pain. On the other hand, if a patient is assured that he is not going to suffer, a little pain will only appeal to him as an unpleasant accident.

Dr. C. C. Allen.—A very curious thing in pursuing these studies is this, that very similar practices obtain in all parts of the earth, in places so far apart that we know that for many thousands of years the inhabitants could not have had communication with one another. Through all this there seems to be a common origin of superstition, and superstition is the beginning of knowledge. The very first professional man to be differentiated from the common laborer of all tribes was a magician, or, as we know him now, the priest or medicine man. He was set apart to do these things, and in the original scheme of things these men were the brightest of the tribes, and generally they were honest. They were not charlatans. Out of that came the professional man and the priest. Again, not all of them remained honest; they took advantage of those incantations and practices to deceive the people and to bring themselves into prominence and prosperity. But originally they started out as good men, and as Dr. Ottolengui said, while we may look upon these things as strange and foolish, in the days of long ago they were practiced honestly. I sometimes think in the ages to come, when the people on the earth look back upon some of our present practices, they will consider them as foolish as some of the things I have told you about. So we are not to make fun of these people. I do not feel I should do so myself. I thank you very kindly for your attention.

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

JAMES DAVID MCCOY, D.D.S., EDITOR
LOS ANGELES, CALIF.

SOME OBSERVATIONS CONCERNING THE REQUIREMENTS OF THE RADIOGRAPHER AND DESCRIPTIVE TERMINOLOGY

BY JAMES DAVID MCCOY, D.D.S., LOS ANGELES, CALIF.
Professor of Orthodontia and Radiography, College of Dentistry, University of Southern California

WHEN William Conrad Roentgen announced his discovery to the world, he called it the *x-ray,* but the civilized world has for the most part seen fit to designate it the *roentgen ray* in honor of the discoverer. Roentgenology is, therefore, defined as "the study and practice of the roentgen ray, as it applies to medicine and surgery."

For purposes of study, roentgenology may be divided into two distinct fields, depending upon the purpose for which the roentgen ray is to be utilized. In the first, which is the one enlisting the interest of dentists, it is used for the production of shadow pictures or radiograms. In other words, it embraces what is commonly called the *field of radiography,* or *roentgenography.*

The other branch mentioned, includes the use of the roentgen ray for therapeutic purposes, and is known as *radiotherapy,* or *roentgenotherapy.* With this field, the dentist is happily not directly concerned, and, therefore, his responsibilities are not as great as the medical roentgenologist.

Of the various collateral sciences of medicine, there is perhaps none which has developed more rapidly, or which has assumed a more important bearing in many branches of practice than has the science of roentgenology. With the increased appreciation of its value and its wide adoption, it has been developed through a comparatively short period of evolution, until now it can be regarded, broadly speaking, in the light of an exact science.

In spite of this fact, there is still apparent a great degree of misconception as to the responsibilities of one who is to actively engage in this work.

To the uninitated, this field of labor often presents alluring possibilities, and they are all too apt to rush in without adequate preparation. To such, the reward of bitter disappointment must eventually come, when they become mired in the mud of their own poor judgment, and lack of technical knowledge.

To avoid such an end, or perhaps what is almost as ignominious,—the acquiring of "a partial knowledge" of the subject, which at best can only carry one-half way upon the journey of success—the student should first come to a realization that the practice of roentgenology or any of its branches requires more than a mere training in the mechanics of the x-ray laboratory.

Undoubtedly, many a man has, in the contemplation of x-ray apparatus for his office, *given serious thought to the type of the equipment which he wished to install,* and has assumed that with a modern laboratory, he would be in a position to render the best of service. Such a misguided individual all too soon learns that a *very large part of the battle lies within himself,* and if his own knowledge is deficient, the finest equipment in the world will not make him a roentgenologist.

It is important, therefore, that those who contemplate any indulgence in the field of radiography should not underestimate the task which confronts them.

In addition to becoming familiar with the electrophysics of x-ray laboratory equipment, its practical application in their chosen field, the dangers which surround it if improperly used, one should realize that the real practice of radiography begins when the x-ray picture, or radiogram, has been produced. It is quite impossible for such an image to be of value, unless the radiographer is thoroughly familiar with the anatomy, physiology, and pathology of the field under examination, and even these qualifications are not adequate unless backed up by practical clinical experience.

For those who can qualify, there is a real field and a rare opportunity, and it will be found that every man who engages in this work will receive just that amount of recognition and respect from his colleagues to which his abilities entitle him.

One of the first things which the beginner should do is to become familiar with the terminology of this subject, and cultivate the habit of using terms correctly. Instead of using the term *x-ray picture,* such an image should always be spoken of as a *radiogram,* or as a *roentgenogram.*

The physician or dentist maintaining an x-ray laboratory, should not be called *an x-ray specialist,* but should be spoken of as *a medical or a dental roentgenologist.*

Not infrequently, we hear physicians or dentists speaking of a dental radiogram as *a dental x-ray.* Such an expression only exposes their crudity of thought, and certainly expresses nothing else.

It is thought by some terminologists that in addition to always speaking of the x-ray as the roentgen ray, in honor of the man who discovered it, we should include the name Roentgen in every descriptive word connected with the work. To such, the term *radiograph* (verb) and *radiogram* (noun) will doubtless appear improper, but I feel justified in continuing their use, as these words are thoroughly descriptive and less cumbersome than *roentgenograph* and *roentgenogram.* For the same reason, the term *radiography* is preferred rather than *roentgenography* to designate the art of making radiograms.

Briefly summarized, the following roentgen terminology will be found to be quite adequate:

Roentgen ray, or X-ray:	A phenomenon in physics discovered by William Conrad Roentgen.
Roentgenology, or Radiology:*	The study and practice of the roentgen ray as applied to medicine and surgery.
Roentgenologist, or Radiologist:*	One skilled in roentgenology.
Roentgenogram, or Radiogram:	The shadow picture produced by the x-ray upon the photographic emulsion.
Roentgenograph, or Radiograph:	(Verb.) To make a roentgenogram, or radiogram.
Roentgenography, or Radiography:	The art of making roentgenograms, or radiograms.
Roentgenotherapy, or Radiotherapy:*	Treatment by the application of the roentgen ray.
Roentgen dermatitis, or X-ray dermatitis:	Skin reaction due to too strong or too often repeated application of the roentgen ray.
Roentgenographic examination, or Radiographic examination:	The examination and study of the shadow pictures produced by the x-ray upon the photographic emulsion.
Roentgen diagnosis, or X-ray diagnosis:	Diagnosis by aid of the roentgen ray.
Pathoroentgenography, or Pathoradiography:	The study of pathologic lesions as revealed by the radiogram (or roentgenogram); it implies and renders imperative a knowledge of the pathology and of the interpretation of normal and abnormal tissue densities as recorded in the radiogram.
Roentgenize:	To apply the roentgen ray.
Roentgenization:	The application of the roentgen ray.
Roentgenism:	The untoward effect of the roentgen ray.

Some writers add other descriptive terms to the foregoing list, but I feel that a terminology should be just as brief as is consistent with adequate description; hence, several terms appearing in current literature on different phases of roentgenology have been omitted.

*The term is rather confusing, as it could also refer to the practice and therapy of radium or other radiotherapeutic agents.

Use and Misuse of the X-Ray

DIAGNOSIS is the finest art in medicine. It involves the summation of the experiences of all the other branches of medicine and is the keystone of any system of treatment. A competent diagnostician becomes so only through thorough acquaintance with pathology and natural history of disease processes, correlated with ample clinical experience. Naturally, there are no short cuts to diagnosis. It is true that brilliant diagnoses may occasionally be made at a glance or by the use of a single laboratory expedient. Such episodes, however, carry with them great danger and conduce to superficiality, lack of thoroughness, and frequent application of the supposed short-cut methods.

Time and again serious mistakes, disastrous to both patient and doctor, occur when such methods continue to be applied with confidence after a brilliant diagnostic coup. He who wishes to avoid such pitfalls will resort to no single method of diagnosis.

We have with us at present an evergrowing tendency to resort to the x-ray, or the roentgenologist, as the sole or principal means of diagnosis. Murphy has styled them mechanical diagnoses, and correctly so.

The x-ray originated in Germany and was first applied there clinically, chiefly in the diagnosis and localization of foreign bodies and in identification of fractures. Cannon of Boston, Pfahler of Philadelphia, and Hemmeter of Baltimore, were the first to use it for the study of physiology and diagnosis of conditions other than foreign bodies and fractures. They, however, did not develop the method sufficiently to make it practicable, nor did they grasp its possibilities until Rieder, Groedel, Holtzknecht and their pupils had taken it up and developed most of what we today know about it. Technically, Americans have made brilliant advances and made the method widely available.

While great good has come and will continue to come from improved technic, nevertheless, the general use of the x-ray by those not properly trained in pathology and x-ray interpretation has resulted in an infinite amount ot error and clinical disaster. Even some of our best known roentgenologists have not escaped and our roentgenologic literature is filled with fantastic ideas and useless advice and procedures, because the American roentgenologist has not been sufficiently trained, as has his European collaborator, in the fundamental branches of medicine, chief of which are pathology and clinical hospital experience.

It is a matter of daily experience to find patients rushed to the x-ray laboratory before any clinical investigation has been made of the case, and often organs have been photographed which would be not at all likely to show any results. Far-reaching interpretations are being placed upon most trivial and often normal findings. This holds particularly true of the lungs and the gastrointestinal tract. Bands of active tissue and sharply defined calcified areas in or about the lungs are interpreted as active processes. Normal shadows and shadows due to plate, posture, and developmental defect are interpreted as disease. Peristaltic waves, spasm, and defects shown on single plates or examinations are repeatedly interpreted as ulcer or cancer in the stomach. Minor degrees of

atony or elongation of the stomach and colon are interpreted as ptosis, and surgical procedures advised; to say nothing of such procedures advised through misinterpretation of other normal, or slightly pathologic, functional states.

On the other hand, through the same sources of error and neglect to appreciate the value of the x-ray, many conditions are overlooked. Probably as many errors are being made through lack of appreciation of the finer changes as are being made through the exaggeration of unimportant changes.

The remedy is coming, but slowly, that is, to insist upon a more thorough fundamental training of all roentgenologists; in fact, a training as great as that of the internist or the surgeon, that they, in turn, may better instruct the profession at large to appreciate that the x-ray should always be considered only as one link, no matter how certain it may be, in the evidence leading to a diagnosis. —*C. E. Sears, M.D., in Medical Sentinel.*

How the New Income Taxes Hit Your Pocket

This table, prepared for the *New York Tribune*, shows how to compute your income tax, beginning with the rates under the law of 1916, and adding the taxes provided by the new war revenue bill.

Income Married Men	Normal Tax (Old Law)	Additional Normal Tax (New Law)	Surtax (Old Law)	Additional Surtax (New Law)	Total Tax
$1,000.......	Exempt	Exempt	Exempt	Exempt	None
2,000.......	Exempt	Exempt	Exempt	Exempt	None
3,000.......	Exempt	2% on $1,000	Exempt	Exempt	$20
4,000.......	Exempt	2% on 2,000	Exempt	Exempt	40
5,000.......	2% on $1,000	2% on 3,000	Exempt	Exempt	80
6,000.......	2% on 2,000	2% on 4,000	Exempt	1% on $1,000	130
7,000.......	2% on 3,000	2% on 5,000	Exempt	1% on 2,000	180
8,000.......	2% on 4,000	2% on 6,000	Exempt	1% on 2,500 2% on 500	235
9,000.......	2% on 5,000	2% on 7,000	Exempt	1% on 2,500 2% on 1,500	295
10,000.......	2% on 6,000	2% on 8,000	Exempt	1% on 2,500 2% on 2,500	355

An unmarried man pays a tax on his income beyond $3,000 under the old law and beyond $1,000 under the new law.

An unmarried man with an income of $5,000 pays 2 per cent on $2,000 under the old law and an additional 2 per cent on $4,000 under the new law.

The International Journal of Orthodontia

PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 801-807 Metropolitan Bldg., St. Louis, Mo

Foreign Depots—*Great Britain*—Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

Subscription Rates—Single Copies, 30 cents. To anywhere in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $3.00 per year in advance. Under foreign postage, $3.40. English price: 15/ per annum, 1/6 per number. Volume begins with January and ends with December of each year.

Remittances—Remittances for subscriptions should be made by check, draft, postoffice or express money order, or registered letter, payable to the publishers, The C. V. Mosby Company.

Contributions—The editor will be pleased to consider the publication of original communications of merit on orthodontic and allied subjects, which must be contributed solely to this journal.

Opinions—Neither the editor nor the publisher hold themselves responsible for the opinions of contributors, nor are they responsible for other than editorial statements.

Reprints—Since it is not desirable to hold type standing longer than absolutely necessary, all requests for reprints should be made at time of submitting manuscript for publication. Rate card will be sent with galley proof.

Communications—Contributed articles, illustrations, letters, books for review, and all other matter pertaining to the editorial department should be addressed to the Editor, Doctor Martin Dewey, 25 East Washington Street, Chicago, Ill. All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 801-807 Metropolitan Building, St. Louis, Mo.

Illustrations—Such halftones and zinc etchings as in the judgment of the editor are necessary to illustrate articles will be furnished when photographs or drawings are supplied by the authors of said articles.

Advertisements—Objectionable advertisements will not be accepted for publication in this journal. Forms close first of month preceding date of issue. Advertising rates and sizes on application.

Change of Address—The publishers should be advised of change of subscriber's address about fifteen days before date of issue, with both new and old addresses given.

Nonreceipt of Copies—Complaints for nonreceipt of copies or requests for extra numbers must be received on or before the fifteenth of the month of publication; otherwise the supply is apt to be exhausted.

Entered at the Post Office at St. Louis, Mo., as Second-Class Matter

EDITORIALS

The Etiology of Malocclusion

THERE have been few questions pertaining to malocclusion which have produced so much discussion or brought forth so many different opinions as has the question of etiology. If one would take the time to review the orthodontic literature, he would find that the causes of malocclusion have always occupied an important field. He would also find that the writers on the subject have been divided into two groups in the old days, those claiming that malocclusion was the result of inheritance and those who claimed that it was the result of purely local conditions. As is the case with a great many questions, the real solution of the problem lies somewhere between the two extremes.

In approaching the question of the etiology of malocclusion in the same manner that any other pathologic matter is approached, we are forced to divide it into two groups; namely, those factors which can be grouped accord-

ing to the time in which they occur and the others according to the manner in which they occur.

Much has been written upon the question of the etiology of malocclusion from a pathologic standpoint during the last few years and the causes have been classified according to the plan which we have outlined. As regards the time, they may be divided into inherited, congenital, and acquired. In regard to the manner in which they develop, they may be divided into local and constitutional. In speaking of local and constitutional causes, we might further elucidate by saying that certain writers have made a division slightly different, in which they have attributed a large number of malocclusions to purely mechanical conditions, or to results arising from abnormal forces of occlusion or abnormal mechanical stress brought to bear upon the teeth and the developing structures. Those writers that have attributed the majority of malocclusions to purely mechanical conditions have, to a great extent, overlooked constitutional causes or conditions which may have a physiologic origin in the cell metabolism of the individual. Faulty development may be the result of conditions occurring in the maternal structure before birth and thereby effecting the embryo.

Investigations into the constitutional causes of malocclusion and conditions which may arise early in life have been carried on by Hellman, Kirk, Mershon, and Weinberger, and papers dealing upon this subject have been published by these writers during the last few years. However, regardless of the large number of valuable contributions to the orthodontic literature which we have dealing with the etiology of malocclusion; showing the relation of malocclusion as a pathologic condition which may arise from a congenital or constitutional disturbance, there still remain a number of writers who cling to the mechanical phase of malocclusion and attribute all malocclusions to purely mechanical conditions.

In the October issue of the *Dental Cosmos* there appear two articles by well-known men who have taken almost exactly the opposite position to each other. One of the writers, following the modern and scientific line of thought, makes the statement that a large number of malocclusions have their beginning probably in the very early stage of development. He states that it is not a mechanical problem at all, but a problem of biology, and one which must be approached from that standpoint. He also states that the abnormal pathologic development of the bones of the face in which the teeth are located is generally the result of faulty development of the child from birth, or probably before birth. This is very probably the more scientific explanation of the cause of a large number of malocclusions than it is to attempt to explain all malocclusions by one or a very few etiologic factors.

Opposed to malocclusion being produced by faulty development as the result of abnormal cell metabolism and constitutional conditions, we find another writer stating that "mouth breathing is by far the most frequent cause of malocclusion of the teeth. With the exception of those malocclusions caused by anomalies such as supernumerary teeth, transposed teeth, and impacted teeth and so forth, all malocclusions may be ascribed to nasal obstruction in early life." It would

be indeed a very fortunate thing if it could be proved that all malocclusions were the result of nasal obstruction in early life, because it would eliminate a large number of the hardships which we have encountered in treatment. However, modern investigation does not prove the fact that malocclusions are the result of mouth-breathing anywhere near to the extent attributed by the writer referred to. There is no question but that mouth-breathing in some cases does play a large part in the production of malocclusion, but if we go back further, there might be a constitutional condition which has been responsible for the mouth-breathing. At the present time, no one seems to know exactly why we have hypertrophied lymphoid tissue in the nasal pharynx and why certain pathologic conditions in the nose and throat occur, which produce mouth-breathing and contribute to the resulting malocclusion.

We do not believe that the solution of etiology will be found by limiting ourselves to the study of any one condition or by making positive statements that mouth-breathing produces all malocclusions except those mentioned in the above referred article. We believe that great advance will be made when the profession realizes that malocclusions are really a pathologic problem, and a great many of them have their beginning at a time when it is impossible to recognize them from a mechanical standpoint. It must be remembered that in the treatment of malocclusion we are not dealing entirely with a mechanical problem, but are dealing with a biologic problem in attempting to produce biologic growths according to such methods as we can employ. The sooner the orthodontic profession realizes that constitutional disturbances and faulty developments are factors which must be met and studied, the sooner will orthodontics make the advance to which it is entitled and receive the recognition from the medical profession it should receive.

Our New President

THE subject of our frontispiece this month is D. Willard Flint, D.D.S., of Pittsburgh, Pa., who was elected President of the American Society of Orthodontists at the Seventeenth Annual Meeting in Excelsior Springs, Mo., Sept. 5th, 1917.

Born in Canada, Dr. Flint attended the Chatham Collegiate Institute for six years, later the University of Michigan, and then the University of Pittsburgh. In the latter institution he held the chair of Orthodontia for five years. He is also a graduate of the Angle School of Orthodontia, Class of 1902.

INDEX TO VOLUME III

AUTHORS INDEX

GENERAL INDEX

H

I

J

K

L

M

U

V

W

X

EDITORIALS

SUGGESTIONS TO CONTRIBUTORS

"The four rules for the preparation of an article will then be: (1) Have something to say; (2) Say it; (3) Stop as soon as you have said it; (4) Give the paper a proper title."[1]

Let your phraseology express one meaning and one only. Be clear.[2]

Manuscript.—Manuscripts should be typewritten, with wide margins, and double spaced, on one side of paper. 8½ by 11 inches in size. The original copy should be sent to the "Journal" and the carbon copy retained by the author. Number the leaves consecutively, beginning with the title page. Put your name and address on the manuscript.

Illustrations.—Illustrations should be clear, preferably pen-and-ink drawings. Of photographs send a good print rather than a negative. Have lettering parallel to the bottom and top margins, and of sufficient size to be clear if cut is to be reduced. Tracings should be in black-and-white; avoid colors. Write your name on back of each picture; number them in one series (Fig. 1, etc.) to the end, and indicate in margin of the manuscript about where each is to be printed. See that the text references and "figures" correspond. Legends for illustrations should be written on a separate sheet.[3]

Bibliographic References.—Give only references actually consulted. If an article is known only through an abstract give reference to the abstract in addition to that of the source. References are printed to be of help in further reading; therefore they must be complete, concise, and correct. Follow the style of the "Index Medicus" and "Index-Catalog of the Library of the Surgeon-General's Office." Be conservative in the use of abbreviations.[4]

Arrangement.—As authors are quoted in the text give each a number in the order of citation, and number the bibliographic reference with the same number. Arrange the references in a list at the end of the article in the order of the numbers (see below), or arrange items in alphabetical order according to last names of authors, and distinguish between articles by the same author by the use of the date after his name in the text.

Footnotes.—Where an author wishes to use footnotes at bottom of each page instead of the bibliography at end of article, the footnotes should be written in the text, but separated from it by horizontal lines above and below, or *better,* place them at bottom of each page. Use figures to indicate these footnotes, and number consecutively (1, 2, 3, etc.) throughout the article. If in addition to the bibliography mentioned above it is desired to use footnotes on certain pages, these can be indicated by an asterisk (*).

Final Reading.—Let some one other than the author read the manuscript with these directions in mind.

Shipment.—Send manuscript flat, postage paid, to Martin Dewey, 25 E. Washington St., Chicago, Ill.

Proof Reading.—Read carefully, with special attention to spelling of names and bibliographic data. Make corrections *in the margin* only with lines drawn from the revision to the point of change in the text. Answer queries in the proof by making correction or crossing out the query. Verify your references from the sources, not from your carbon copy.

References. (Read these.)

[1]Billings, J. S.: Our Medical Literature, Trans. VII Intern. Med. Congress, Lond., 1881, i, 54-70.

[2]Mayer, Emil: Medical Literature and its Preparation, Med. Record, N. Y., 1915, lxxxvii, 1019-1021.

Allbutt, T. C.: Notes on the Composition of Scientific Papers. London, Macmillan, 1904.

McCrae, Thomas: The Use of Words, Jour. A. M. A., Chic., 1915, lxv, 135-139.

[3]Suggestions to Medical Authors, issued by the A. M. A. Press, Chic., A. M. A., [1914 (?)].

[4]Place, F.: Bibliographic Style in Medical Literature, Med. Record, N. Y., 1913, lxxxiii, 157-160.